ANEXA A1

PROGRAM DE REGLARE NUMERICA A TURATIEI UNUI MOTOR DE CURENT CONTINUU

-VARIANTA CHOPPERULUI CU TIRISTOARE-

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                        ;
                        ;   PROGRAM DE REGLARE NUMERICA A TURATIEI UNUI MCC
                        ;
                        ;                                VARIANTA TIRISTORIZATA
                        ;
                        ;           INITIALIZARI VARIABILE SI COEFICIENTI
2023                    BYTE    EQU     2023H   ;OCTET DE CONTROL PENTRU
                                                ;RST 7.5
2022                    WK      EQU     2022H   ;MARIME PRESCRISA wk
200B                    W1      EQU     200BH   ;MARIME PRESCRISA wk-1
2026                    RK      EQU     2026H   ;REACTIE rk
2027                    RK1     EQU     2027H   ;REACTIE rk-1
2028                    YK      EQU     2028H   ;MARIME DE COMANDA yk
2024                    YK1     EQU     2024H   ;MARIME DE COMANDA yk-1
2021                    SIGN    EQU     2021H   ;SEMN ABATERE
2001                    ADCOD   EQU     2001H   ;ADRESA PRESCRIERE DE LA DAF
202B                    TEST    EQU     202BH   ;VARIABILA FANION
4441                    CRLF    EQU     4441H   ;SUBRUTINA PENTRU CR, LF
2012                    ADAD    EQU     2012H   ;ADRESA CURENTA PENTRU
                                                ;RECEPTIE DAF
2000                    FAN     EQU     2000H   ;FANION RECEPTIE COMPLETA DAF
                                PAGE
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                        ;
                                ORG     20CEH   ;AICI SE AJUNGE PRIN RST 7.5
20CE'   C3 8300                 JMP     8300H   ;SALT  IN INTERRUPT TIMER
                        ;
                                ORG     8300H
                                        ;SUBRUTINA INTERRUPT TIMER
8300'   F5                      PUSH    PSW
8301'   FB                      EI
8302'   3A 2023                 LDA     BYTE
8305'   B7                      ORA     A
8306'   CA 8321'                JZ      I1      ;SALT DACA  BYTE = ALFA
8309'   3C                      INR     A
830A'   C2 8312'                JNZ     I2      ;SALT DACA BYTE = GAMMA
830D'   32 2023                 STA     BYTE    ;BYTE A FOST BETA, VA FI ALFA
8310'   F1                      POP     PSW
8311'   C9                      RET
8312'   21 2026         I2:     LXI     H,RK    ;TRATAREA PENTRU BYTE = GAMMA
8315'   56                      MOV     D,M     ;D=RK
8316'   71                      MOV     M,C     ;RK=REZULTAT MASURA
8317'   23                      INX     H
8318'   72                      MOV     M,D     ;RK1=D
8319'   E1                      POP     H       ;IGNORARE PSW SALVAT INITIAL
831A'   E1                      POP     H       ;IGNORARE ADRESA DE INTOARCERE
                                                ;IN PROGRAMUL APELANT
831B'   FA 8548'                JM      R2C     ;BYTE=GAMMA2
831E'   C3 84A8'                JMP     T       ;BYTE=GAMMA1
8321'   3E 08            I1:     MVI     A,8     ;TRATARE PENTRU BYTE=ALFA
8323'   D3 29                   OUT     29H     ;COMANDA Th2
8325'   3E 07                   MVI     A,7
8327'   3D              I1A:    DCR     A
8328'   C2 8327'                JNZ     I1A     ;INTIRZIERE PENTRU FORMAREA
                                                ;IMPULSULUI
832B'   D3 29                   OUT     29H
832D'   3E FF                   MVI     A,255
832F'   32 2023                 STA     BYTE    ;BYTE=BETA
8332'   E5                      PUSH    H
8333'   2A 2024                 LHLD    YK1
8336'   7C                      MOV     A,H
8337'   D6 3C                   SUI     3CH
8339'   2F                      CMA
833A'   67                      MOV     H,A
833B'   7D                      MOV     A,L
833C'   2F                      CMA
833D'   6F                      MOV     L,A
833E'   23                      INX     H       ;HL=T/2-HL
833F'   7C                      MOV     A,H
8340'   E6 3F                   ANI     3FH     ;MASCARE PE 14 BITI
8342'   C6 80                   ADI     80H     ;MOD DE LUCRU 2
8344'   D3 2D                   OUT     2DH     ;TIMER HIGH
8346'   7D                      MOV     A,L
8347'   D3 2C                   OUT     2CH     ;TIMER LOW
8349'   E1                      POP     H
834A'   3E C1                   MVI     A,0C1H
834C'   D3 28                   OUT     28H     ;START  TIMER
```

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834E'  F1                      POP     PSW
834F'  C9                      RET
                               PAGE
```

```
                                ;
                                ;                       SUBRUTINA MASURA
                                ;
                                        ORG     2030H   ;IN STATIC RAM
2030'   3E BC                   MAS:   MVI     A,0BCH
2032'   D3 2D                           OUT     2DH
2034'   3E 00                           MVI     A,0
2036'   D3 2C                           OUT     2CH     ;TIMER=5msec
2038'   3E C1                           MVI     A,0C1H
203A'   0E 00                           MVI     C,0     ;CONTOR=0
203C'   D3 28                           OUT     28H     ;START TIMER
203E'   DB 2A                   EF1:   IN      2AH
2040'   E6 08                           ANI     8
2042'   47                             MOV     B,A
2043'   DB 2A                   EF2:   IN      2AH
2045'   E6 08                           ANI     8
2047'   B8                             CMP     B
2048'   CA 2043'                       JZ      EF2
204B'   0C                             INR     C       ;NUMARARE TRANZITII
204C'   C3 203E'                       JMP     EF1
                                        PAGE
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                        ;
                        ;                                   SUBRUTINA CALCUL ARN
                        ;
                              ORG     8380H
8380'  2A 2024          ARN:  LHLD    YK1
8383'  AF               ARN1: XRA     A
8384'  32 2021                STA     SIGN    ;SIGN=0
8387'  3A 2026                LDA     RK
838A'  47                     MOV     B,A
838B'  3A 2022                LDA     WK
838E'  90                     SUB     B       ;A=W-R
838F'  D2 839B'               JNC     C3      ;SALT DACA W>=R
8392'  2F                     CMA             ;W<R
8393'  3C                     INR     A
8394'  47                     MOV     B,A     ;R=-A
8395'  3E 01                  MVI     A,1
8397'  32 2021                STA     SIGN    ;SIGN=1
839A'  78                     MOV     A,B     ;A=B
                        ;
839B'  57               C3:   MOV     D,A
839C'  47                     MOV     B,A
839D'  B7                     ORA     A
839E'  1F                     RAR
839F'  5F                     MOV     E,A
83A0'  3E 00                  MVI     A,0
83A2'  1F                     RAR
83A3'  4F                     MOV     C,A
83A4'  78                     MOV     A,B
83A5'  83                     ADD     E
83A6'  47                     MOV     B,A
83A7'  7A                     MOV     A,D
83A8'  B7                     ORA     A
83A9'  17                     RAL
83AA'  5F                     MOV     E,A
83AB'  3E 00                  MVI     A,0
83AD'  17                     RAL
83AE'  57                     MOV     D,A
83AF'  79                     MOV     A,C
83B0'  93                     SUB     E
83B1'  4F                     MOV     C,A
83B2'  78                     MOV     A,B
83B3'  9A                     SBB     D
83B4'  47                     MOV     B,A
83B5'  7B                     MOV     A,E
83B6'  B7                     ORA     A
83B7'  17                     RAL
83B8'  5F                     MOV     E,A
83B9'  7A                     MOV     A,D
83BA'  17                     RAL
83BB'  57                     MOV     D,A
83BC'  79                     MOV     A,C
83BD'  93                     SUB     E
83BE'  4F                     MOV     C,A
83BF'  78                     MOV     A,B
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83C0'   9A                      SBB     D
83C1'   47                      MOV     B,A
                        ;                       S-A EXECUTAT OPERATIA BC=378*A
83C2'   3A 2021                 LDA     SIGN
83C5'   B7                      ORA     A
83C6'   CA 83D0'                JZ      C5      ;SALT DACA  SIGN=0
83C9'   79                      MOV     A,C
83CA'   2F                      CMA
83CB'   4F                      MOV     C,A
83CC'   78                      MOV     A,B
83CD'   2F                      CMA
83CE'   47                      MOV     B,A


83CF'   03                      INX     B       ;SIGN=1; BC=-BC
83D0'   09              C5:     DAD     B       ;HL=HL+BC
83D1'   3E 01                   MVI     A,1
83D3'   32 2021                 STA     SIGN    ;SIGN=1
83D6'   3A 2027                 LDA     RK1
83D9'   47                      MOV     B,A
83DA'   3A 200B                 LDA     W1
83DD'   90                      SUB     B       ;A=W-R
83DE'   D2 83E9'                JNC     C8      ;SALT DACA W>=R
83E1'   2F                      CMA
83E2'   3C                      INR     A
83E3'   47                      MOV     B,A     ;B=-A
83E4'   AF                      XRA     A
83E5'   32 2021                 STA     SIGN    ;SIGN=0
83E8'   78                      MOV     A,B     ;A=-B
                        ;
83E9'   47              C8:     MOV     B,A
83EA'   4F                      MOV     C,A
83EB'   B7                      ORA     A
83EC'   1F                      RAR
83ED'   5F                      MOV     E,A
83EE'   3E 00                   MVI     A,0
83F0'   1F                      RAR
83F1'   57                      MOV     D,A
83F2'   7B                      MOV     A,E
83F3'   1F                      RAR
83F4'   5F                      MOV     E,A
83F5'   7A                      MOV     A,D
83F6'   1F                      RAR
83F7'   57                      MOV     D,A
83F8'   81                      ADD     C
83F9'   4F                      MOV     C,A
83FA'   78                      MOV     A,B
83FB'   8B                      ADC     E
83FC'   47                      MOV     B,A
83FD'   B7                      ORA     A
83FE'   7B                      MOV     A,E
83FF'   1F                      RAR
8400'   5F                      MOV     E,A
8401'   7A                      MOV     A,D
8402'   1F                      RAR
8403'   81                      ADD     C
8404'   4F                      MOV     C,A
8405'   78                      MOV     A,B
```

```
8406' 8B                        ADC     E
8407' 47                        MOV     B,A
                        ;                       S-A EXECUTAT OPERATIA BC=353*A
8408' 3A 2021                   LDA     SIGN
840B' B7                        ORA     A
840C' CA 8416'                  JZ      C10     ;SALT DACA SIGN=0
840F' 79                        MOV     A,C
8410' 2F                        CMA
8411' 4F                        MOV     C,A
8412' 78                        MOV     A,B
8413' 2F                        CMA
8414' 47                        MOV     B,A
8415' 03                        INX     B       ;SIGN=1 ; BC=-BC
8416' 09                C10:    DAD     B       ;HL=HL+BC
8417' 3A 202B                   LDA     TEST
841A' B7                        ORA     A
841B' CA 842A'                  JZ      C14     ;SALT DACA TEST=0
841E' 3E 71                     MVI     A,71H   ;TEST=1
8420' BC                        CMP     H       ;TEST DEPASIRE SUPERIOARA
8421' D2 8432'                  JNC     C15
8424' 21 7200                   LXI     H,7200H ;CORECTIE DEPASIRE
8427' C3 8432'                  JMP     C15
842A' 7C                C14:    MOV     A,H
842B' B7                        ORA     A       ;TEST DEPASIRE INFERIOARA
842C' F2 8432'                  JP      C15
842F' 21 0000                   LXI     H,0     ;CORECTIE DEPASIRE
8432' 22 2028           C15:    SHLD    YK
8435' C9                        RET
                                PAGE
```

```
                        ;
                        ;                       PROGRAMUL PRINCIPAL
                        ;
                              ORG     8480H
8480'  31 BFFE                LXI     SP,OBFFEH       ;INITIALIZARE STIVA
8483'  AF                     XRA     A
8484'  32 2022                STA     WK      ;INITIALIZARI VARIABILE
8487'  32 2026                STA     RK
848A'  32 20C9                STA     20C9H   ;ADRESA LOW PENTRU RST 6.5
                                              ;ESTE  00
848D'  32 2027                STA     RK1
8490'  32 2000                STA     FAN
8493'  32 2028                STA     YK
8496'  32 2029                STA     YK+1
8499'  3E 01                  MVI     A,1
849B'  D3 28                  OUT     28H     ;PROGRAMARE PORTURI 29H, 2AH
849D'  3E 09                  MVI     A,9
849F'  30                     DB      30H     ;ACEASTA ESTE INSTRUCTIUNEA SI
84A0'  3E 87                  MVI     A,87H
84A2'  32 20CA                STA     20CAH   ;ADRESA HIGH PENTRU RST 6.5
                                              ;ESTE 87H
84A5'  C3 84A8'               JMP     T
                        ;
84A8'                   T:    ORG     8500H

8500'  3A 2028                LDA     YK
8503'  32 2024                STA     YK1     ;YK1=YK (LOW)
8506'  3A 2029                LDA     YK+1
8509'  32 2025                STA     YK1+1   ;YK1=YK (HIGH)
850C'  AF                     XRA     A
850D'  32 202B                STA     TEST
8510'  3A 2022                LDA     WK
8513'  32 200B                STA     W1      ;WK1=WK
8516'  3A 2000                LDA     FAN
8519'  FE 02                  CPI     2
851B'  C2 8528'               JNZ     PP1
851E'  3A 2001                LDA     ADCOD
8521'  32 2022                STA     WK
8524'  AF                     XRA     A
8525'  32 2000                STA     FAN
                        ;
8528'  3A 2025          PP1:  LDA     YK1+1
852B'  FE 3C                  CPI     3CH
852D'  FA 8570'               JM      PP2     ;SALT IN REGIMUL 1 SAU  3
                        ;
8530'  3E DD            R2:   MVI     A,ODDH  ;REGIMUL 2
8532'  32 2023                STA     BYTE    ;BYTE=GAMMA2
8535'  3E 04                  MVI     A,4
8537'  D3 29                  OUT     29H     ;COMANDA Th1
8539'  3E 07                  MVI     A,7
853B'  3D               R2T:  DCR     A
853C'  C2 853B'               JNZ     R2T     ;INTIRZIERE PENTRU FORMAREA
                                              ;IMPULSULUI
853F'  D3 29                  OUT     29H
```

```
8541'  3C                        INR     A
8542'  32 202B                   STA     TEST    ;TEST=1
8545'  C3 2030'                  JMP     MAS
8548'  AF              R2C:      XRA     A
8549'  32 2023                   STA     BYTE    ;BYTE=ALFA
854C'  2A 2024                   LHLD    YK1
854F'  7C                        MOV     A,H
8550'  D6 3C                     SUI     3CH
8552'  32 2025                   STA     YK1+1   ;YK1=YK1-T/2
8555'  E6 3F                     ANI     3FH
8557'  C6 80                     ADI     80H
8559'  D3 2D                     OUT     2DH
855B'  7D                        MOV     A,L
855C'  D3 2C                     OUT     2CH     ;TIMER=YK1
855E'  3E C1                     MVI     A,0C1H
8560'  D3 28                     OUT     28H     ;START TIMER
8562'  CD 8383'                  CALL    ARN1
8565'  76                        HLT
8566'  3A 2023            R2A:      LDA     BYTE
8569'  B7                        ORA     A
856A'  C2 8566'                  JNZ     R2A     ;SALT DACA BYTE <> ALFA
856D'  C3 84A8'                  JMP     T       ;SALT DACA BYTE = ALFA
                         ;
8570'  FE 01            PP2:      CPI     1
8572'  D2 8591'                  JNC     R1      ;SALT IN REGIMUL 1
                         ;                       REGIMUL 3
8575'  3E 19            R3:       MVI     A,25
8577'  32 2023                   STA     BYTE    ;BYTE=BETA
857A'  3C                        INR     A
857B'  D3 2C                     OUT     2CH
857D'  3E BC                     MVI     A,0BCH
857F'  D3 2D                     OUT     2DH     ;TIMER=T/2
8581'  3E C1                     MVI     A,0C1H
8583'  D3 28                     OUT     28H     ;START TIMER


8585'  CD 8380'                  CALL    ARN
8588'  76                        HLT
8589'  3E 23                     MVI     A,23H
858B'  32 2023                   STA     BYTE    ;BYTE=GAMMA1
858E'  C3 2030'                  JMP     MAS
                         ;                       REGIMUL 1
8591'  3E 04            R1:       MVI     A,4
8593'  D3 29                     OUT     29H     ;AMORSARE Th1
8595'  3E 07                     MVI     A,7
8597'  3D              R1T:      DCR     A
8598'  C2 8597'                  JNZ     R1T     ;FORMARE IMPULS
859B'  D3 29                     OUT     29H
859D'  AF                        XRA     A
859E'  32 2023                   STA     BYTE    ;BYTE=ALFA
85A1'  3A 2024                   LDA     YK1
85A4'  D3 2C                     OUT     2CH
85A6'  3A 2025                   LDA     YK1+1
85A9'  E6 3F                     ANI     3FH
85AB'  C6 80                     ADI     80H
85AD'  D3 2D                     OUT     2DH     ;TIMER=YK1
85AF'  3E C1                     MVI     A,0C1H
85B1'  D3 28                     OUT     28H
```

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85B3'  CD 8380'                  CALL   ARN
85B6'  76                        HLT
85B7'  3A 2023            R1A:   LDA    BYTE
85BA'  B7                        ORA    A
85BB'  C2 85B7'                  JNZ    R1A     ;SALT DACA BYTE <> ALFA
85BE'  3E 23                     MVI    A,23H   ;BYTE = ALFA
85C0'  32 2023                   STA    BYTE    ;BYTE = GAMMA1
85C3'  C3 2030'                  JMP    MAS
                                 PAGE
```

```
                        ;
                        ;                       SUBRUTINA INTERRUPT DAF
                        ;
                        ORG     8700H
8700'  F5               PUSH    PSW
8701'  C5               PUSH    B
8702'  3A 7000          LDA     7000H
8705'  CD 4336          CALL    4336H   ;TRANSFORMA A(DAF) IN B(ASCII)
8708'  E3               XTHL
8709'  E3               XTHL
870A'  E3               XTHL
870B'  E3               XTHL
870C'  E3               XTHL
870D'  E3               XTHL
870E'  E3               XTHL
870F'  E3               XTHL            ;INTIRZIERE CERUTA DE
                                        ;INTERFATA CU DAF-UL
8710'  CD 4436          CALL    4436H   ;TRIMITE B(ASCII) CATRE DAF
8713'  3A 2000          LDA     FAN
8716'  B7               ORA     A
8717'  C2 872A'         JNZ     ED1     ;SALT DACA FAN >= 1
871A'  78               MOV     A,B     ;FAN=0; A=CARACTER ASCII
871B'  CD 4565          CALL    4565H   ;CONVERSIE  A(ASCII) IN A(HEXA)
871E'  32 2001          STA     ADCOD   ;DEPOZITARE PROVIZORIE
8721'  3E 01            MVI     A,1
8723'  32 2000          STA     FAN     ;FAN=1
8726'  C1               POP     B
8727'  F1               POP     PSW
8728'  FB               EI
8729'  C9               RET
872A'  78       ED1:    MOV     A,B     ;FAN=1; A=CARACTER ASCII
872B'  CD 4565          CALL    4565H   ;CONVERSIE A(ASCII) IN A(HEXA)
872E'  47               MOV     B,A     ;B=ULTIMUL CARACTER
                                        ;RECEPTIONAT (HEXA)
872F'  E5               PUSH    H
8730'  21 2001          LXI     H,ADCOD
8733'  7E               MOV     A,M     ;A=PRIMUL CARACTER
                                        ;RECEPTIONAT (HEXA)
8734'  07               RLC
8735'  07               RLC
8736'  07               RLC
8737'  07               RLC
8738'  B7               ORA     A       ;FORMARE OCTET DIN CELE 2
                                        ;CARACTERE
8739'  77               MOV     M,A     ;ADCOD = VALOARE RECEPTIONATA
873A'  E1               POP     H
873B'  3E 02            MVI     A,2
873D'  32 2000          STA     FAN     ;FAN=2 (RECEPTIE COMPLETA)
8740'  CD 4441          CALL    CRLF    ;CAR RETURN, LINE FEED
8743'  C1               POP     B
8744'  F1               POP     PSW
8745'  FB               EI
8746'  C9               RET
```

END

Macros:

Symbols:

2012	ADAD	2001	ADCOD	8380'	ARN
8383'	ARN1	2023	BYTE	8416'	C10
842A'	C14	8432'	C15	839B'	C3
83D0'	C5	83E9'	C8	4441	CRLF
872A'	ED1	203E'	EF1	2043'	EF2
2000	FAN	8321'	I1	8327'	I1A
8312'	I2	2030'	MAS	8528'	PP1
8570'	PP2	8591'	R1	85B7'	R1A
8597'	R1T	8530'	R2	8566'	R2A
8548'	R2C	853B'	R2T	8575'	R3
2026	RK	2027	RK1	2021	SIGN
84A8'	T	202B	TEST	200B	W1
2022	[illegible]	2028	YK	2024	YK1

No Fatal error(s)

ANEXA A2

PROGRAM DE REGLARE NUMERICA A TURAȚIEI
UNUI MOTOR DE CURENT CONTINUU

-VARIANTA CHOPPERULUI CU TRANZISTOARE-

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                        ;
                        ;   PROGRAM DE REGLARE NUMERICA A TURATIEI UNUI MCC
                        ;
                        ;                                   VARIANTA TRANZISTORIZATA
                        ;
                        ;          INITIALIZARI VARIABILE SI COEFICIENTI
202C                    SRK     EQU     202CH   ;SEMN RK
202D                    SRK1    EQU     SRK+1   ;SEMN RK1
202E                    SW      EQU     SRK+2   ;SEMN WK
200B                    SW1     EQU     200BH   ;SEMN W1
201E                    YT      EQU     201EH   ;MARIME DE COMANDA PENTRU
                                                ;TIMER
2015                    D0      EQU     2015H   ;COEFICIENT d0
2017                    D1      EQU     2017H   ;COEFICIENT d1
2023                    BYTE    EQU     2023H   ;OCTET DE CONTROL PENTRU
                                                ;RST 7.5
2022                    WK      EQU     2022H   ;MARIME PRESCRISA wk
200B                    W1      EQU     200BH   ;MARIME PRESCRISA wk-1
2026                    RK      EQU     2026H   ;REACTIE rk
2027                    RK1     EQU     2027H   ;REACTIE rk-1
2028                    YK      EQU     2028H   ;MARIME DE COMANDA yk
2024                    YK1     EQU     2024H   ;MARIME DE COMANDA yk-1
2021                    SIGN    EQU     2021H   ;SEMN ABATERE
200C                    KR      EQU     200CH   ;COEFICIENT kr
200E                    TI      EQU     200EH   ;COEFICIENT Ti
2001                    ADCOD   EQU     2001H   ;ADRESA PRESCRIERE DE LA DAF
202B                    TEST    EQU     202BH   ;VARIABILA FANION
4441                    CRLF    EQU     4441H   ;SUBRUTINA PENTRU CR, LF
2012                    ADAD    EQU     2012H   ;ADRESA CURENTA PENTRU
                                                ;RECEPTIE DAF
2019                    ADIN    EQU     2019H   ;ADRESA INITIALA PENTRU
                                                ;RECEPTIE DAF
2014                    ADSI    EQU     2014H   ;SEMN ADCOD
4437                    OU      EQU     4437H   ;SUBRUTINA  PENTRU CR, LF
D000                    MES1    EQU     0D000H  ;ADRESA MESAJ 1
D1A0                    MES2    EQU     0D1A0H  ;ADRESA MESAJ 2
D1B0                    MES3    EQU     0D1B0H  ;ADRESA MESAJ 3
D200                    MES4    EQU     0D200H  ;ADRESA MESAJ 4
456D                    HOUT    EQU     456DH   ;SUBRUTINA OUT DAF (HEXA)
45AD                    SCRN    EQU     45ADH   ;SUBRUTINA EDITARE TEXTE PE DAF
2000                    FAN     EQU     2000H   ;FANION RECEPTIE COMPLETA DAF
                                PAGE
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                        ;
                                ORG     20CEH   ;AICI SE AJUNGE PRIN RST 7.5
20CE'   C3 8800                 JMP     8800H   ;SALT  IN INTERRUPT TIMER
                        ;
                                ORG     8800H
                                        ;SUBRUTINA INTERRUPT TIMER
8800'   F5                      PUSH    PSW
8801'   FB                      EI
8802'   3A 2023                 LDA     BYTE
8805'   B7                      ORA     A
8806'   CA 882D'                JZ      I1      ;SALT DACA  BYTE = ALFA
8809'   3C                      INR     A
880A'   C2 8812'                JNZ     I2      ;SALT DACA BYTE = GAMMA
880D'   32 2023                 STA     BYTE    ;BYTE A FOST BETA, VA FI ALFA
8810'   F1                      POP     PSW
8811'   C9                      RET
8812'   F5              I2:     PUSH    PSW     ;TRATAREA PENTRU BYTE = GAMMA
8813'   21 2026                 LXI     H,RK
8816'   56                      MOV     D,M     ;D=RK
8817'   71                      MOV     M,C     ;RK=REZULTAT MASURA
8818'   23                      INX     H
8819'   72                      MOV     M,D     ;RK1=D
881A'   2E 2C                  MVI     L,2CH   ;HL=ADRESA SRK
881C'   56                      MOV     D,M     ;D=SRK
881D'   DB 08                   IN      8       ;PRELUARE SEMN REACTIE
881F'   E6 01                   ANI     1       ;MASCARE
8821'   77                      MOV     M,A     ;SRK=A
8822'   F1                      POP     PSW     ;RESTAURARE FLAGURI (I2)
8823'   23                      INX     H       ;HL=ADRESA SRK1
8824'   72                      MOV     M,D     ;SRK1=D
8825'   E1                      POP     H       ;IGNORARE PSW SALVAT INITIAL
8826'   E1                      POP     H       ;IGNORARE ADRESA DE INTOARCERE
                                                ;IN PROGRAMUL APELANT
8827'   FA 8592'                JM      R2C     ;BYTE=GAMMA2
882A'   C3 84E5'                JMP     T       ;BYTE=GAMMA1
882D'   D3 29           I1:     OUT     29H
882F'   3E FF                   MVI     A,255
8831'   32 2023                 STA     BYTE    ;BYTE=BETA
8834'   E5                      PUSH    H
8835'   2A 201E                 LHLD    YT
8838'   7C                      MOV     A,H
8839'   D6 3C                   SUI     3CH
883B'   2F                      CMA
883C'   67                      MOV     H,A
883D'   7D                      MOV     A,L
883E'   2F                      CMA
883F'   6F                      MOV     L,A
8840'   23                      INX     H       ;HL=T/2-HL
8841'   7C                      MOV     A,H
8842'   E6 3F                   ANI     3FH     ;MASCARE PE 14 BITI
8844'   C6 80                   ADI     80H     ;MOD DE LUCRU 2
8846'   D3 2D                   OUT     2DH     ;TIMER HIGH
8848'   7D                      MOV     A,L
8849'   D3 2C                   OUT     2CH     ;TIMER LOW
```

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884B'   E1                      POP     H
884C'   3E C1                   MVI     A,0C1H
884E'   D3 28                   OUT     28H     ;START  TIMER
8850'   F1                      POP     PSW
8851'   C9                      RET
                                PAGE
```

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                                ;
                                ;                              SUBRUTINA MASURA
                                ;
                                        ORG     2030H          ;IN STATIC RAM
2030'   3E BC                   MAS:    MVI     A,0BCH
2032'   D3 2D                           OUT     2DH
2034'   3E 00                           MVI     A,0
2036'   D3 2C                           OUT     2CH            ;TIMER=5msec
2038'   3E C1                           MVI     A,0C1H
203A'   0E 00                           MVI     C,0            ;CONTOR=0
203C'   D3 28                           OUT     28H            ;START TIMER
203E'   DB 2A                   EF1:    IN      2AH
2040'   E6 08                           ANI     8
2042'   47                              MOV     B,A
2043'   DB 2A                   EF2:    IN      2AH
2045'   E6 08                           ANI     8
2047'   B8                              CMP     B
2048'   CA 2043'                        JZ      EF2
204B'   0C                              INR     C              ;NUMARARE TRANZITII
204C'   C3 2042'                        JMP     EF2-1
                                        PAGE
```

```
                                ;
                                ;                                SUBRUTINA CALCUL ARN
                                ;
                                        ORG     8880H
8880'   2A 2024                ARN:    LHLD    YK1
8883'   AF                      ARN1:   XRA     A
8884'   32 2021                         STA     SIGN    ;SIGN=0
8887'   3A 202C                         LDA     SRK
888A'   47                              MOV     B,A
888B'   3A 202E                         LDA     SW
888E'   A8                              XRA     B
888F'   C2 88B3'                        JNZ     A2      ;SALT PENTRU SEMNE DIFERITE
8892'   B0                              ORA     B       ;SEMNE IDENTICE
8893'   3A 2026                         LDA     RK
8896'   47                              MOV     B,A
8897'   3A 2022                         LDA     WK
889A'   C2 88AD'                        JNZ     A3      ;SALT DACA W<0 SI R<0
889D'   90                              SUB     B       ;W>=0 SI R>=0 ; A=W-R
889E'   D2 88D4'                A4:     JNC     C3      ;SALT DACA W>=R
88A1'   2F                              CMA
88A2'   3C                              INR     A
88A3'   47                              MOV     B,A
88A4'   3E 01                           MVI     A,1
88A6'   32 2021                         STA     SIGN    ;SIGN=1
88A9'   78                              MOV     A,B
88AA'   C3 88D4'                        JMP     C3
88AD'   4F                      A3:     MOV     C,A
88AE'   78                              MOV     A,B
88AF'   91                              SUB     C       ;A=W-R
88B0'   C3 889E'                        JMP     A4
88B3'   A8                      A2:     XRA     B
88B4'   3A 2026                         LDA     RK
88B7'   47                              MOV     B,A
88B8'   3A 2022                         LDA     WK
88BB'   C2 88C7'                        JNZ     A5      ;SALT DACA W<0 SI R>=0
88BE'   80                              ADD     B       ;W>=0 SI R<0 ; A=W+R
88BF'   D2 88D4'                        JNC     C3
88C2'   3E FF                           MVI     A,255   ;CORECTIE DEPASIRE
88C4'   C3 88D4'                        JMP     C3
88C7'   80                      A5:     ADD     B       ;A=W+R
88C8'   47                              MOV     B,A
88C9'   3E 01                           MVI     A,1
88CB'   32 2021                         STA     SIGN    ;SIGN=1
88CE'   78                              MOV     A,B
88CF'   D2 88D4'                        JNC     C3
88D2'   3E FF                           MVI     A,255   ;CORECTIE DEPASIRE
88D4'   EB                      C3:     XCHG
88D5'   2A 2015                         LHLD    D0
88D8'   CD 8770'                        CALL    INO     ;INMULTIRE CU do
88DB'   AF                              XRA     A
88DC'   32 2021                         STA     SIGN    ;SIGN=0
88DF'   3A 202D                         LDA     SRK1
88E2'   47                              MOV     B,A
88E3'   3A 200B                         LDA     SW1
```

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```
88E6' A8                        XRA     B
88E7' C2 890B'                  JNZ     A6      ;SALT PENTRU SEMNE DIFERITE
88EA' B0                        ORA     B       ;SEMNE IDENTICE
88EB' 3A 2027                   LDA     RK1
88EE' 47                        MOV     B,A
88EF' 3A 200B                   LDA     W1
88F2' CA 8905'                  JZ      A7      ;SALT DACA W>=0 SI R>=0
88F5' 90                        SUB     B       ;W<0 SI R<0 ; A=W-R
88F6' D2 892C'          A8:     JNC     C8      ;SALT DACA W>=R
88F9' 2F                        CMA
88FA' 3C                        INR     A
88FB' 47                        MOV     B,A
88FC' 3E 01                     MVI     A,1
88FE' 32 2021                   STA     SIGN    ;SIGN=1
8901' 78                        MOV     A,B
8902' C3 892C'                  JMP     C8
8905' 4F                A7:     MOV     C,A
8906' 78                        MOV     A,B
8907' 91                        SUB     C       ;A=R-W
8908' C3 88F6'                  JMP     A8
890B' A8                A6:     XRA     B
890C' 3A 2027                   LDA     RK1
890F' 47                        MOV     B,A
8910' 3A 200B                   LDA     W1
8913' CA 891F'                  JZ      A9      ;SALT DACA W>=0 SI R<0
8916' 80                        ADD     B       ;A=W+R
8917' D2 892C'                  JNC     C8
891A' 3E FF                     MVI     A,255   ;CORECTIE DEPASIRE
891C' C3 892C'                  JMP     C8
891F' 80                A9:     ADD     B       ;A=W+R
8920' 47                        MOV     B,A
8921' 3E 01                     MVI     A,1
8923' 32 2021                   STA     SIGN    ;SIGN=1
8926' 78                        MOV     A,B
8927' D2 892C'                  JNC     C8
892A' 3E FF                     MVI     A,255   ;CORECTIE DEPASIRE
892C' EB                C8:     XCHG
892D' 2A 2017                   LHLD    D1
8930' CD 8770'                  CALL    INO     ;INMULTIRE CU d1
8933' C9                        RET             ;REZULTATUL NECORECTAT IN H
                        ;
                        ;                       PROGRAMUL PRINCIPAL
                        ;
                                ORG     84A0H
84A0' 31 BFFE                  LXI     SP,0BFFEH       ;INITIALIZARE STIVA
84A3' AF                        XRA     A
84A4' D3 0A                     OUT     10      ;PROGRAMARE PORT B
84A6' 32 2022                   STA     WK      ;INITIALIZARI VARIABILE
84A9' 32 201E                   STA     YT
84AC' 32 201F                   STA     YT+1
84AF' 32 202E                   STA     SW
84B2' 32 202B                   STA     TEST
84B5' 32 202C                   STA     SRK
84B8' 32 202D                   STA     SRK1
84BB' 32 2026                   STA     RK
84BE' 32 2014                   STA     ADSI
```

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```
84C1' 32 20C9                   STA     20C9H   ;ADRESA LOW PENTRU RST 6.5
                                                ;ESTE  00
84C4' 32 2027                   STA     RK1
84C7' 32 2000                   STA     FAN
84CA' 32 2028                   STA     YK
84CD' 32 2029                   STA     YK+1
84D0' 3E 01                     MVI     A,1
84D2' D3 28                     OUT     28H     ;PROGRAMARE PORTURI 29H SI 2AH
84D4' 3E 09                     MVI     A,9
84D6' 30                        DB      30H     ;ACEASTA ESTE INSTRUCTIUNEA SI
84D7' 3E 87                     MVI     A,87H
84D9' 32 20CA                   STA     20CAH   ;ADRESA HIGH PENTRU RST 6.5
                                                ;ESTE 87H
84DC' 21 2019                   LXI     H,ADIN
84DF' 22 2012                   SHLD    ADAD
84E2' C3 84E5'                  JMP     T
                        ;
84E5'                   T:      ORG     8500H

8500' 3A 2028                   LDA     YK
8503' 32 2024                   STA     YK1     ;YK1=YK (LOW)
8506' 3A 2029                   LDA     YK+1
8509' 32 2025                   STA     YK1+1   ;YK1=YK (HIGH)
850C' 3A 2022                   LDA     WK
850F' 4F                        MOV     C,A     ;C=WK
8510' 32 200B                   STA     W1      ;W1=WK
8513' 3A 202E                   LDA     SW
8516' 32 200B                   STA     SW1     ;SW1=SW
8519' 3A 2000                   LDA     FAN
851C' B7                        ORA     A
851D' CA 8570'                  JZ      PP1     ;SALT PENTRU FAN=0
8520' 3A 2001                   LDA     ADCOD
8523' 57                        MOV     D,A     ;D=WDAF
8524' 3A 2014                   LDA     ADSI
8527' 47                        MOV     B,A     ;B=SDAF
8528' 3A 202E                   LDA     SW      ;A=SW
852B' A8                        XRA     B
852C' 79                        MOV     A,C     ;A=WK
852D' C2 855D'                  JNZ     T1      ;SALT PENTRU SEMNE DIFERITE
8530' BA                        CMP     D       ;SEMNE IDENTICE
8531' DA 8543'                  JC      T2      ;SALT PENTRU WDAF>WK
8534' D6 14                     SUI     20      ;WDAF<=WK ; A=WK-20
8536' DA 854F'                  JC      T3      ;SALT PENTRU A<0
                                                ;(DEPASIRE INFERIOARA)
8539' 32 2022                   STA     WK      ;WK=A
853C' BA                        CMP     D
853D' D2 8570'                  JNC     PP1     ;SALT DACA WDAF<=A
                                                ;(PRELUAREA NU S-A TERMINAT)
8540' C3 854F'                  JMP     T3      ;SALT DACA WDAF>A
8543' C6 14             T2:     ADI     20      ;WDAF>WK ; A=WK+20
8545' DA 854F'                  JC      T3      ;SALT IN CAZ DE DEPASIRE
8548' 32 2022                   STA     WK      ;WK=A
854B' BA                        CMP     D
854C' DA 8570'                  JC      PP1     ;SALT DACA WDAF>A
                                                ;(PRELUAREA NU S-A TERMINAT)
854F' 7A                T3:     MOV     A,D     ;FINAL PRELUARE
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8550' 32 2022                   STA     WK      ;WK=WDAF
8553' AF                        XRA     A
8554' 32 2000                   STA     FAN     ;FAN=0 (RECEPTIE COMPLETA)
8557' 32 2014                   STA     ADSI    ;ADSI=0
855A' C3 8570'                  JMP     PP1
855D' D6 14             T1:     SUI     20      ;SEMNE DIFERITE ;  A=WK-20
855F' 32 2022                   STA     WK      ;WK=A
8562' D2 8570'                  JNC     PP1     ;SALT DACA A>0
                                                ;(PRELUAREA NU S-A TERMINAT)
8565' 2F                        CMA
8566' 3C                        INR     A
8567' 4F                        MOV     C,A
8568' 78                        MOV     A,B
8569' 32 2025                   STA     SW      ;SW=SDAF
856C' 79                        MOV     A,C
856D' C3 854B'                  JMP     T3-4    ;SALT IN RAMURA CU SEMNE
                                                ;IDENTICE
8570' 3A 2025           PP1:    LDA     YK1+1
8573' B7                        ORA     A
8574' F2 8575'                  JP      J+1
8577' 2F                        CMA
8578' FE 3C                     CPI     3CH
857A' FA 85EB'                  JM      PP2     ;SALT IN REGIMUL 1 SAU 3
                        ;
857D' 3E DD             R2:     MVI     A,0DDH  ;REGIMUL 2
857F' 32 2023                   STA     BYTE    ;BYTE=GAMMA2
8582' 3A 202B                   LDA     TEST
8585' B7                        ORA     A
8586' 3E 04                     MVI     A,4
8588' CA 858D'                  JZ      R2T     ;SALT DACA TEST=0 ; A=4
858B' C6 04                     ADI     4       ;TEST=1 ; A=8
858D' D3 29             R2T:    OUT     29H     ;COMANDA TRANZISTOARE
858F' C3 2030'                  JMP     MAS
8592' AF                R2C:    XRA     A
8593' 32 2023                   STA     BYTE    ;BYTE=ALFA
8596' 2A 2024                   LHLD    YK1
8599' 84                        ADD     H       ;A=YK1 (HIGH)
859A' E5                        PUSH    H
859B' F2 85AA'                  JP      R2B     ;SALT DACA YK1>=0
859E' C6 3C                     ADI     3CH     ;YK1<0
85A0' 2F                        CMA
85A1' 67                        MOV     H,A
85A2' 7D                        MOV     A,L
85A3' 2F                        CMA
85A4' 6F                        MOV     L,A
85A5' 23                        INX     H       ;HL=!YK1!-T/2
85A6' 7C                        MOV     A,H
85A7' C3 85AD'                  JMP     R2E
85AA' D6 3C             R2B:    SUI     3CH
85AC' 67                        MOV     H,A     ;HL=YK1-T/2
85AD' 22 201E           R2E:    SHLD    YT      ;YT=HL
85B0' E6 3F                     ANI     3FH
85B2' C6 80                     ADI     80H
85B4' D3 2D                     OUT     2DH
85B6' 7D                        MOV     A,L
85B7' D3 2C                     OUT     2CH     ;TIMER=HL
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```
85B9' 3E C1                    MVI   A,0C1H
85BB' D3 28                    OUT   28H     ;START TIMER
85BD' E1                       POP   H
85BE' CD 8883'                 CALL  ARN1
85C1' 3A 202B                  LDA   TEST
85C4' B7                       ORA   A
85C5' C2 85D4'                 JNZ   R2P     ;SALT DACA YK1<0
85C8' 3E 77                    MVI   A,77H   ;YK1>0
85CA' BC                       CMP   H       ;TEST DEPASIRE SUPERIOARA
85CB' D2 85DD'                 JNC   R2D
85CE' 21 77F0                  LXI   H,77F0H ;CORECTIE DEPASIRE
85D1' C3 85DD'                 JMP   R2D
85D4' 3E 87              R2P:  MVI   A,87H
85D6' BC                       CMP   H       ;TEST DEPASIRE INFERIOARA
85D7' DA 85DD'                 JC    R2D
85DA' 21 8810                  LXI   H,8810H ;CORECTIE DEPASIRE
85DD' 22 2028            R2D:  SHLD  YK      ;YK=REZULTAT CALCUL ARN,
                                             ;CORECTAT
85E0' 76                       HLT
85E1' 3A 2023            R2A:  LDA   BYTE
85E4' B7                       ORA   A
85E5' C2 85E1'                 JNZ   R2A     ;SALT DACA BYTE <> ALFA
85E8' C3 84E5'                 JMP   T       ;SALT DACA BYTE =  ALFA
                         ;
85EB' B7                 PP2:  ORA   A
85EC' C2 861C'                 JNZ   R1
85EF' 3A 2024                  LDA   YK1
85F2' B7                       ORA   A
85F3' C2 861C'                 JNZ   R1
                         ;                     REGIMUL 3
85F6' 3E FF              R3:   MVI   A,255
85F8' 32 2023                  STA   BYTE    ;BYTE=BETA
85FB' 3C                       INR   A
85FC' D3 2C                    OUT   2CH
85FE' 3E BC                    MVI   A,0BCH
8600' D3 2D                    OUT   2DH     ;TIMER=T/2
8602' 3E C1                    MVI   A,0C1H
8604' D3 28                    OUT   28H     ;START TIMER
8606' CD 8880'                 CALL  ARN
8609' 7C                       MOV   A,H
860A' 07                       RLC
860B' E6 01                    ANI   1
860D' 32 202B                  STA   TEST    ;ACTUALIZARE VARIABILA "TEST"
8610' 22 2028                  SHLD  YK      ;YK=REZULTAT CALCUL ARN,
                                             ;CORECTAT
8613' 76                       HLT
8614' 3E 23                    MVI   A,23H
8616' 32 2023                  STA   BYTE    ;BYTE=GAMMA1
8619' C3 2030'                 JMP   MAS
                         ;                     REGIMUL 1
861C' 3A 202B            R1:   LDA   TEST
861F' B7                       ORA   A
8620' 3E 04                    MVI   A,4
8622' CA 8627'                 JZ    R1T     ;SALT DACA TEST=0 ; A=4
8625' C6 04                    ADI   4       ;TEST=1 ; A=8
8627' D3 29              R1T:  OUT   29H     ;COMANDA TRANZISTOARE
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8629'  2A 2024              LHLD   YK1
862C'  AF                   XRA    A
862D'  32 2023              STA    BYTE    ;BYTE=ALFA
8630'  84                   ADD    H
8631'  E5                   PUSH   H
8632'  F2 863B'             JP     R1B     ;SALT DACA YK1>=0
8635'  2F                   CMA
8636'  67                   MOV    H,A
8637'  7D                   MOV    A,L
8638'  2F                   CMA
8639'  6F                   MOV    L,A
863A'  23                   INX    H       ;HL=!YK1!
863B'  22 201E        R1B:  SHLD   YT
863E'  7D                   MOV    A,L
863F'  D3 2C                OUT    2CH
8641'  7C                   MOV    A,H
8642'  E6 3F                ANI    3FH
8644'  C6 80                ADI    80H
8646'  D3 2D                OUT    2DH     ;TIMER=HL
8648'  3E C1                MVI    A,0C1H
864A'  D3 28                OUT    28H     ;START TIMER
864C'  E1                   POP    H
864D'  CD 8883'             CALL   ARN1
8650'  7C                   MOV    A,H
8651'  07                   RLC
8652'  E6 01                ANI    1
8654'  32 202B              STA    TEST    ;ACTUALIZARE VARIABILA TEST
8657'  22 2028              SHLD   YK      ;YK=REZULTAT CALCUL ARN,
                                           ;CORECTAT
865A'  76                   HLT
865B'  3A 2023        R1A:  LDA    BYTE
865E'  B7                   ORA    A
865F'  C2 865B'             JNZ    R1A     ;SALT DACA BYTE <> ALFA
8662'  3E 23                MVI    A,23H   ;BYTE=ALFA
8664'  32 2023              STA    BYTE    ;BYTE=GAMMA1
8667'  C3 2030'             JMP    MAS
                            PAGE
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                        ;
                        ;                       SUBRUTINA  INTERRUPT DAF
                        ;
                        ORG     8700H
8700'  F5               PUSH    PSW
8701'  C5               PUSH    B
8702'  E5               PUSH    H
8703'  2A 2012           LHLD    ADAD    ;HL=ADRESA ADRESEI CURENTE
8706'  3A 7000           LDA     7000H
8709'  CD 4336           CALL    4336H   ;TRANSFORMA A(DAF) IN B(ASCII)
870C'  0E 19             MVI     C,25
870E'  0D                DCR     C
870F'  C2 870B'          JNZ     J-4     ;INTIRZIERE CERUTA DE
                                         ;INTERFATA CU DAF-UL
8712'  78                MOV     A,B     ;A=CARACTER ASCII RECEPTIONAT
8713'  FE 2D             CPI     '-'
8715'  C2 8723'          JNZ     ED2     ;SALT DACA NU E "MINUS"
8718'  CD 4437           CALL    OU      ;TRIMITE ECOU CATRE DAF
871B'  3E 01             MVI     A,1
871D'  32 2014           STA     ADSI    ;ADSI=1
8720'  C3 8730'          JMP     ED3
8723'  FE 0D     ED2:    CPI     13
8725'  CA 8735'          JZ      ED1     ;SALT DACA E "RETURN"
8728'  CD 4437           CALL    OU      ;ECOU CATRE DAF
872B'  70                MOV     M,B     ;INSCRIERE IN SIRUL DE
                                         ;CARACTERE
872C'  23                INX     H
872D'  22 2012           SHLD    ADAD    ;ADAD=ADAD+1
8730'  E1        ED3:    POP     H       ;RESTAURARE REGISTRE -
                                         ;FINAL SUBRUTINA
8731'  C1                POP     B
8732'  F1                POP     PSW
8733'  FB                EI
8734'  C9                RET
                        ;
8735'  3E 3D     ED1:    MVI     A,'='
8737'  CD 4437           CALL    OU      ;TRIMITE LA DAF '='
873A'  36 00             MVI     M,0     ;SFIRSIT SIR CARACTERE
                                         ;RECEPTIONATE
873C'  3A 2014           LDA     ADSI
873F'  B7                ORA     A
8740'  CA 8748'          JZ      ED4     ;SALT DACA ADSI=0
8743'  3E 2D             MVI     A,'-'   ;DACA NU,
8745'  CD 4437           CALL    OU      ;TRIMITE LA DAF '-'
8748'  01 2019   ED4:    LXI     B,ADIN
874B'  21 2019           LXI     H,ADIN
874E'  22 2012           SHLD    ADAD    ;ADAD=ADRESA INITIALA
8751'  D5                PUSH    D
8752'  CD 4534           CALL    4534H   ;TRANSFORMA CIFRELE ZECIMALE
                                          (ASCII) INCEPIND DE LA ADRESA
                        ;                 BC IN HEXA (HL). REVENIREA
                        ;                 DIN SUBRUTINA SE FACE LA
                        ;                 PRIIMUL ZERO (00) INTILNIT.
                        ;                 SUBRUTINA AFECTEAZA TOATE
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                                ;                       REGISTRELE.
8755'  E5                               PUSH    H
8756'  7D                               MOV     A,L
8757'  CD 456D                          CALL    HOUT    ;TRIMITE A LA DAF
                                                        ;(FORMAT HEXA)
875A'  E1                               POP     H
875B'  D1                               POP     D
875C'  3E 48                            MVI     A,'H'
875E'  CD 4437                          CALL    OU      ;TRIMITE LA DAF 'H'
8761'  CD 4441                          CALL    CRLF    ;CAR RETURN, LINE FEED
8764'  7D                               MOV     A,L
8765'  32 2001                         STA     ADCOD   ;ADCOD=VALOAREA RECEPTIONATA
8768'  3E 01                            MVI     A,1
876A'  32 2000                         STA     FAN     ;FAN=1
876D'  C3 8730'                         JMP     ED3
                                        PAGE
```

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```
                        ;
8770' 47                INO:    MOV     B,A
8771' EB                        XCHG
8772' 3A 2021                   LDA     SIGN
8775' B7                        ORA     A
8776' CA 8780'                  JZ      INM     ;SALT DACA SIGN=0
8779' 7A                        MOV     A,D     ;SIGN=1
877A' 2F                        CMA
877B' 57                        MOV     D,A
877C' 7B                        MOV     A,E
877D' 2F                        CMA
877E' 5F                        MOV     E,A
877F' 13                        INX     D       ;DE=-DE
                        ;                       SUBRUTINA  INM EXECUTA
                        ;                       OPERATIA HL=HL+B*DE
8780' 0E 08             INM:    MVI     C,8
8782' 78                IN2:    MOV     A,B
8783' 1F                        RAR
8784' 47                        MOV     B,A
8785' D2 8789'                  JNC     IN3
8788' 19                        DAD     D
8789' EB                IN3:    XCHG
878A' 29                        DAD     H
878B' EB                        XCHG
878C' 0D                        DCR     C
878D' C2 8782'                  JNZ     IN2
8790' C9                        RET
                                PAGE
```

```
                        ;
                        ;       DIALOGUL OFF-LINE CU OPERATORUL UMAN
                        ;
                                ORG     0C100H
C100'   21 D000 .               LXI     H,MES1  ;ADRESA PRIMULUI MESAJ
C103'   0E 0A                   MVI     C,10    ;NUMAR DE RINDURI
C105'   CD 45AD         SI:    CALL    SCRN    ;TRIMITE LA DAF SIRUL DE
                        ;                       CARACTERE INCEPIND DE LA
                        ;                       ADRESA HL PINA LA PRIMUL
                        ;                       RETURN INTILNIT
                        ;                       (ACESTA NU ESTE TRANSMIS)
C108'   CD 4441                 CALL    CRLF    ;CAR RETURN, LINE FEED
C10B'   23                      INX     H       ;SALT PESTE CODUL RETURN
C10C'   0D                      DCR     C
C10D'   C2 C105'                JNZ     SI
                        ;
C110'   21 D1A0                 LXI     H,MES2
C113'   CD C1A3'                CALL    SO      ;RECEPTIE KR
C116'   21 D1B0                 LXI     H,MES3
C119'   CD C1A3'                CALL    SO      ;RECEPTIE Ti
C11C'   01 D1A0                 LXI     B,MES2
C11F'   CD 4534                 CALL    4534H   ;CONVERSIE HEXA
C122'   22 200C                 SHLD    KR
C125'   01 D1B0                 LXI     B,MES3
C128'   CD 4534                 CALL    4534H   ;CONVERSIE HEXA
C12B'   22 200E                 SHLD    TI
                        ;
C12E'   06 7B                   MVI     B,123
C130'   2A 200C                 LHLD    KR
C133'   EB                      XCHG            ;DE=KR
C134'   21 0C00                 LXI     H,0     ;HL=0
C137'   CD 8780'                CALL    INM     ;HL=123*KR (a)
C13A'   11 0004                 LXI     D,4
C13D'   CD C193'                CALL    IMP     ;BC=HL/4  (b)
C140'   60                      MOV     H,B
C141'   69                      MOV     L,C     ;HL=(b)
C142'   22 200C                 SHLD    KR      ;SALVARE PROVIZORIE
C145'   EB                      XCHG            ;DE=(b)
C146'   21 0000                 LXI     H,0     ;HL=0
C149'   06 05                   MVI     B,5
C14B'   CD 8780'                CALL    INM     ;HL=(b)*5 (c)
C14E'   EB                      XCHG
C14F'   2A 200E                 LHLD    TI
C152'   EB                      XCHG            ;DE=Ti
C153'   CD C193'                CALL    IMP     ;BC=(c)/Ti (d)
C156'   2A 200C                 LHLD    KR      ;HL=(b)
C159'   09                      DAD     B
C15A'   22 2015                 SHLD    DO      ;dC=(b)+(d)
C15D'   78                      MOV     A,B
C15E'   2F                      CMA
C15F'   47                      MOV     B,A
C160'   79                      MOV     A,C
C161'   2F                      CMA
C162'   4F                      MOV     C,A
```

```
C163'  03                          INX   B
C164'  09                          DAD   B
C165'  09                          DAD   B
C166'  22 2017                     SHLD  D1      ;d1=(b)-(d)
                           ;
C169'  0E 04                       MVI   C,4
C16B'  21 D200                     LXI   H,MES4
C16E'  CD 45AD             SJ:     CALL  SCRN
C171'  CD 4441                     CALL  CRLF
C174'  23                          INX   H
C175'  0D                          DCR   C
C176'  C2 C16E'                    JNZ   SJ
C179'  CD 45AD                     CALL  SCRN
C17C'  EB                          XCHG
C17D'  2A 2015                     LHLD  D0      ;HL=d0
C180'  CD C1B9'                    CALL  S3
C183'  23                          INX   H
C184'  CD 45AD                     CALL  SCRN
C187'  EB                          XCHG
C188'  2A 2017                     LHLD  D1
C18B'  CD C1B9'                    CALL  S3
C18E'  23                          INX   H
C18F'  CD 45AD                     CALL  SCRN
C192'  C9                          RET           ;REVENIRE IN SISTEMUL
                                                 ;DE OPERARE
                           ;
C193'  01 0000             IMP:    LXI   B,0     ;SUBRUTINA EXECUTA
                                                 ;IMPARTIREA BC=HL/DE
C196'  7B                          MOV   A,E
C197'  2F                          CMA
C198'  5F                          MOV   E,A
C199'  7A                          MOV   A,D
C19A'  2F                          CMA
C19B'  57                          MOV   D,A
C19C'  13                          INX   D
C19D'  19                  IM1:    DAD   D
C19E'  D0                          RNC
C19F'  03                          INX   B
C1A0'  C3 C19D'                    JMP   IM1
                           ;
C1A3'  CD 4429             SO:     CALL  4429H   ;ASTEAPTA SOSIREA UNUI
                                                 ;CARACTER DE LA DAF,
                                                 ;IL TRANSFORMA IN B (ASCII
C1A6'  70                          MOV   M,B
C1A7'  78                          MOV   A,B
C1A8'  CD 4437                     CALL  OU      ;ECOU CATRE DAF
C1AB'  78                          MOV   A,B
C1AC'  FE 0D                       CPI   13
C1AE'  23                          INX   H
C1AF'  C2 C1A3'                    JNZ   SO      ;SALT DACA NU E "RETURN"
C1B2'  2B                          DCX   H
C1B3'  36 00                       MVI   M,0     ;SFIIRSIT SIR DE CARACTERE
                                                 ;RECEPTIONATE
C1B5'  CD 4441                     CALL  CRLF
C1B8'  C9                          RET
```

```
C1B9'  EB              S3:   XCHG          ;SUBRUTINA TRIMITE LA DAF HL,
                                           ;IN FORMAT HEXA  SI ZECIMAL
C1BA'  E5                    PUSH  H
C1BB'  7A                    MOV   A,D
C1BC'  CD 456D               CALL  HOUT
C1BF'  7B                    MOV   A,E
C1C0'  CD 456D               CALL  HOUT
C1C3'  E1                    POP   H
C1C4'  23                    INX   H
C1C5'  CD 45AD               CALL  SCRN
C1C8'  23                    INX   H
C1C9'  E5                    PUSH  H
C1CA'  21 0000               LXI   H,0
C1CD'  7A              S4:   MOV   A,D
C1CE'  B3                    ORA   E
C1CF'  CA C1DF'              JZ    S2
C1D2'  1B                    DCX   D
C1D3'  7D                    MOV   A,L
C1D4'  3C                    INR   A
C1D5'  27                    DAA
C1D6'  6F                    MOV   L,A
C1D7'  7C                    MOV   A,H
C1D8'  CE 00                 ACI   0
C1DA'  27                    DAA
C1DB'  67                    MOV   H,A
C1DC'  C3 C1CD'              JMP   S4
C1DF'  7C              S2:   MOV   A,H
C1E0'  5D                    MOV   E,L
C1E1'  CD 456D               CALL  HOUT
C1E4'  7B                    MOV   A,E
C1E5'  CD 456D               CALL  HOUT
C1E8'  E1                    POP   H
C1E9'  CD 45AD               CALL  SCRN
C1EC'  CD 4441               CALL  CRLF
C1EF'  C9                    RET
                             END
```

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Macros:

Symbols:

88B3'	A2	88AD'	A3	889E'	A4
88C7'	A5	890B'	A6	8905'	A7
88F6'	A8	891F'	A9	2012	ADAD
2001	ADCOD	2019	ADIN	2014	ADSI
8880'	ARN	8883'	ARN1	2023	BYTE
88D4'	C3	892C'	C8	4441	CRLF
2015	D0	2017	D1	8735'	ED1
8723'	ED2	8730'	ED3	8748'	ED4
203E'	EF1	2043'	EF2	2000	FAN
456D	HOUT	882D'	I1	8812'	I2
C19D'	IM1	C193'	IMP	8770'	IN0
8782'	IN2	8789'	IN3	8780'	INM
200C	KR	2030'	MAS	D000	MES1
D1A0	MES2	D1B0	MES3	D200	MES4
4437	OU	8570'	PP1	85EB'	PP2
861C'	R1	865B'	R1A	863B'	R1B
8627'	R1T	857D'	R2	85E1'	R2A
85AA'	R2B	8592'	R2C	85DD'	R2D
85AD'	R2E	85D4'	R2P	858D'	R2T
85F6'	R3	2026	RK	2027	RK1
C1DF'	S2	C1B9'	S3	C1CD'	S4
45AD	SCRN	C105'	SI	2021	SIGN
C16E'	SJ	C1A3'	SO	202C	SRK
202D	SRK1	202E	SW	200B	SW1
84E5'	T	855D'	T1	8543'	T2
854F'	T3	202B	TEST	200E	TI
200B	W1	2022	WK	2028	YK
2024	YK1	201E	YT		

No Fatal error(s)

ANEXA A3

PROGRAM DE REGLARE NUMERICA A VITEZEI SI POZITIEI PENTRU UN SISTEM DE ACTIONARE CU MOTOR DE CURENT CONTINUU

```
0000'   09                 R
                           ;
                           ;                          Program de reglare numerica
                           ;                          a vitezei si pozitiei unui MCC
                           ;
                           ;                          Definire  coeficienti
                           ;                          si variabile
2016                       ADAD    EQU     2016H      ;adresa curenta pentru
                                                      ;receptie DAF
2018                       D0      EQU     2018H      ;coeficient D0
2019                       D1      EQU     D0+1       ;coeficient D1
201A                       D2      EQU     D0+2       ;coeficient D2
201C                       D3      EQU     D0+4       ;coeficient D3
201E                       D4      EQU     D0+6       ;coeficient D4
2020                       YK      EQU     D0+8       ;marime de comanda y(k)
2022                       YK1     EQU     D0+10      ;marime de comanda y(k-1)
2024                       YS      EQU     D0+12      ;semn YK
2025                       YS1     EQU     D0+13      ;semn YK1
2026                       YT      EQU     D0+14      ;marime de comanda TIMER
2028                       WK      EQU     D0+16      ;marime prescrisa w(k)
202A                       W1      EQU     D0+18      ;marime prescrisa w(k-1)
202C                       RK      EQU     D0+20      ;reactie r(k)
202E                       RK1     EQU     D0+22      ;reactie r(k-1)
2030                       RK2     EQU     D0+24      ;reactie r(k-2)
2034                       BYTE    EQU     D0+28      ;octet control pentru RST 7.5
2035                       FAN     EQU     D0+29      ;fanion receptie completa DAF
2036                       ADIN    EQU     D0+30      ;adresa initiala  pentru
                                                      ;receptie DAF
456D                       HOUT    EQU     456DH      ;subrutina OUT DAF (HEXA)
4437                       OU      EQU     4437H      ;subrutina OUT DAF (ASCII)
                                   PAGE
```

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```
                                ;
                                ;                       Subrutina INTERRUPT TIMER
                                ;
                                        ORG     20CEH
20CE'   C3 20D1'                        JMP     IT      ;salt in RAM-ul dinamic
                                ;
20D1'                           IT:     ORG     86B0H
86B0'   FB                              EI
86B1'   3A 2034                         LDA     BYTE
86B4'   B7                              ORA     A
86B5'   C0                              RNZ             ;return daca byte <> 0,
                                                        ;contiua daca byte=0
86B6'   D3 29                           OUT     29H     ;blocare tranzistoare
86B8'   7C                              MOV     A,H
86B9'   D6 3C                           SUI     3CH
86BB'   2F                              CMA
86BC'   67                              MOV     H,A
86BD'   7D                              MOV     A,L
86BE'   2F                              CMA
86BF'   6F                              MOV     L,A
86C0'   23                              INX     H       ;HL=T/2-HL
86C1'   7C                              MOV     A,H
86C2'   E6 3F                           ANI     3FH     ;mascare pe 14 biti
86C4'   C6 80                           ADI     80H     ;mod de lucru 2
86C6'   D3 2D                           OUT     2DH     ;TIMER high
86C8'   7D                              MOV     A,L
86C9'   D3 2C                           OUT     2CH     ;TIMER low
86CB'   3E C1                           MVI     A,0C1H
86CD'   32 2034                         STA     BYTE    ;byte=0C1H
86D0'   D3 28                           OUT     28H     ;start TIMER
86D2'   76                              HLT             ;se asteapta in HLT o cerere
                                                        ;de intrerupere
86D3'   C9                              RET             ;de la  TIMER
                                        PAGE
```

```
                        ;
                        ;                       Programul principal
                        ;
                        ORG     8600H
8600'  31 0000          LXI     SP,0    ;initializare stiva
8603'  AF               XRA     A
8604'  32 20C9          STA     20C9H   ;adresa low pentru RST 6.5
                                        ;este 00
8607'  21 2020          LXI     H,2020H
860A'  06 20            MVI     B,32
860C'  77               MOV     M,A
860D'  05               DCR     B
860E'  23               INX     H
860F'  C2 8609'         JNZ     $-6     ;initializari variabile
8612'  D3 02            OUT     2       ;programare port 0
8614'  D3 03            OUT     3       ;programare port 11.
8616'  3E 02            MVI     A,2
8618'  D3 0A            OUT     10      ;programare port 8
861A'  D3 08            OUT     8       ;CLEAR numarator
861C'  AF               XRA     A
861D'  D3 08            OUT     8
861F'  3E 87            MVI     A,87H
8621'  32 20CA          STA     20CAH   ;adresa high pentru RST 6.5
                                        ;este 87H
8624'  21 2036          LXI     H,ADIN
8627'  22 2016          SHLD    ADAD
862A'  3E 09            MVI     A,9
862C'  30               DB      30H     ;aceasta este instructiunea SIM
862D'  C3 20B8'         JMP     T
                        ;
8630'                   ORG     2050H   ;in RAM-ul static
2050'  3E 09            MVI     A,9     ;sint validate RST 6.5, RST 7.5
2052'  30               DB      30H     ;aceasta este  instructiunea SI
2053'  2A 2020          LHLD    YK
2056'  22 2022          SHLD    YK1     ;yk1=yk
2059'  3A 2024          LDA     YS
205C'  32 2025          STA     YS1     ;ys1=ys
                        ;           preluare pozitie curenta de la numarator
205F'  DB 00            CP1:    IN      0
2061'  6F                       MOV     L,A
2062'  DB 01            CP2:    IN      1
2064'  67                       MOV     H,A
2065'  DB 01                    IN      1
2067'  BC                       CMP     H
2068'  CA 206E'                 JZ      CP3
206B'  DB 01                    IN      1
206D'  67                       MOV     H,A
206E'  DB 00            CP3:    IN      0
2070'  BD                       CMP     L
2071'  C2 205F'                 JNZ     CP1
2074'  22 2020                  SHLD    YK
2077'  C3 207A'         K:      JMP     PP1
                        ;
207A'                   PP1:    ORG     8900H
```

```
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8900'  3A 2025                  LDA     YS1
8903'  B7                       ORA     A
8904'  2A 2022                  LHLD    YK1
8907'  EB                       XCHG            ;DE=yk1
8908'  06 04                    MVI     B,4
890A'  CA 8912'                 JZ      PP2     ;salt daca ys1=0;  B=4
890D'  06 08                    MVI     B,8     ;ys=255; B=8
890F'  CD 20AB'                 CALL    AIN
8912'  7A               PP2:   MOV     A,D
8913'  FE 3C                   CPI     3CH
8915'  FA 892F'                JM      PP3     ;salt in regimul 1
                        ;                       Regimul 2
8918'  D6 3C                    SUI     3CH
891A'  67                       MOV     H,A
891B'  6B                       MOV     L,E
891C'  22 2026                  SHLD    YT      ;yt=!yk1!-T/2
891F'  78                       MOV     A,B
8920'  D3 29                    OUT     29H     ;comanda tranzistoare
8922'  CD 8743'                 CALL    SBR1    ;etapa de calcul
8925'  2A 2026                  LHLD    YT
8928'  76                       HLT
8929'  CD 8808'                 CALL    SBR2    ;etapa de comanda
892C'  C3 2088'                 JMP     T
                        ;                       Regimul 1
892F'  FE 00             PP3:   CPI     0
8931'  C2 893A'                 JNZ     PP4
8934'  7B                       MOV     A,E
8935'  B7                       ORA     A
8936'  C2 893A'                 JNZ     PP4
8939'  1C                       INR     E       ;daca yk1=0, atunci DE=1
893A'  EB               PP4:   XCHG
893B'  78                       MOV     A,B
893C'  D3 29                    OUT     29H     ;comanda tranzisoare
893E'  CD 8808'                 CALL    SBR2    ;etapa de comanda
8941'  3E 09                    MVI     A,9     ;sint validate RST 6.5,RST 7.5
8943'  30                       DB      30H     ;aceasta este instructiunea SIM
8944'  CD 8743'                 CALL    SBR1    ;etapa de calcul
8947'  76                       HLT
8948'  C3 2088'                 JMP     T
                                PAGE
```

```
                          ;
                          ;                          Subrutina  INTERRUPT DAF
                          ;
                                  ORG     8700H
8700'   F5                        PUSH    PSW
8701'   C5                        PUSH    B
8702'   E5                        PUSH    H
8703'   2A 2016                   LHLD    ADAD     ;HL=adresa curenta
8706'   3A 7000                   LDA     7000H    ;A=caracter emis de DAF
8709'   CD 4336                   CALL    4336H    ;conversie A(DAF) - B(ASCII)
870C'   78                        MOV     A,B
870D'   FE 0D                     CPI     13
870F'   CA 8734'                  JZ      ED1      ;salt daca e "RETURN"
8712'   FE 18                     CPI     24
8714'   C2 871D'                  JNZ     ED2      ;salt daca nu e "CLEAR"
8717'   CD 4437                   CALL    OU       ;ecou "CLEAR"
871A'   C3 872F'                  JMP     ED3
871D'   FE 30             ED2:    CPI     30H
871F'   DA 872F'                  JC      ED3      ;salt daca e < '0'
8722'   FE 40                     CPI     40H
8724'   D2 872F'                  JNC     ED3      ;salt daca e > '9'
8727'   CD 4437                   CALL    OU       ;ecou cifra zecimala
872A'   70                        MOV     M,B      ;inscriere in sir
872B'   23                        INX     H
872C'   22 2016                   SHLD    ADAD     ;ADAD = ADAD+1
872F'   E1                ED3:    POP     H        ;final subrutina
8730'   C1                        POP     B
8731'   F1                        POP     PSW
8732'   FB                        EI
8733'   C9                        RET
8734'   3E 3D             ED1:    MVI     A,'='
8736'   CD 4437                   CALL    OU       ;ecou  '='
8739'   36 00                     MVI     M,0
873B'   3E 01                     MVI     A,1
873D'   32 2035                   STA     FAN      ;FAN=1
8740'   C3 872F'                  JMP     ED3
                                  PAGE
```

```
                        ;
                        ;                Subrutina SBR1 ( etapa de calcul )
                        ;
8743'  3E BC    SBR1:   MVI     A,0BCH
8745'  D3 2D            OUT     2DH
8747'  AF               XRA     A
8748'  D3 2C            OUT     2CH     ;TIMER=5msec
874A'  3E C1            MVI     A,0C1H
874C'  D3 28            OUT     28H     ;start TIMER
874E'  3E 01            MVI     A,1
8750'  32 2034          STA     BYTE    ;BYTE=1
                        ;
8753'  2A 2028  ARN:    LHLD    WK
8756'  EB               XCHG            ;DE=wk
8757'  2A 2022          LHLD    YK1     ;HL=yk1
875A'  3A 2025          LDA     YS1
875D'  4F               MOV     C,A     ;C=ys1
875E'  3A 2018          LDA     D0
8761'  47               MOV     B,A     ;B=D0
8762'  AF               XRA     A       ;A=0
8763'  CD 2081'          CALL    I24     ;CHL=CHL+B*ADE
8766'  EB               XCHG
8767'  2A 202A          LHLD    W1
876A'  EB               XCHG            ;DE=w1
876B'  3A 2019          LDA     D1
876E'  47               MOV     B,A     ;B=D1
876F'  CD 207A'          CALL    I2M     ;CHL=CHL-B*ADE
8772'  EB               XCHG
8773'  2A 202C          LHLD    RK
8776'  EB               XCHG            ;DE=rk
8777'  3A 201B          LDA     D2+1    ;A=D2(high)
877A'  B7               ORA     A
877B'  CA 8782'          JZ      AR2     ;salt daca A=0
877E'  47       AR1:    MOV     B,A
877F'  CD 209D'          CALL    A2M     ;CHL=CHL-256*B*DE
8782'  3A 201A  AR2:    LDA     D2
8785'  47               MOV     B,A     ;B=D2(low)
8786'  EB               XCHG
8787'  2A 202C          LHLD    RK
878A'  EB               XCHG            ;DE=rk
878B'  CD 207A'          CALL    I2M     ;CHL=CHL-B*ADE
878E'  EB               XCHG
878F'  2A 202E          LHLD    RK1
8792'  EB               XCHG            ;DE=rk1
8793'  3A 201D          LDA     D3+1    ;A=D3(high)
8796'  B7               ORA     A
8797'  CA 879E'          JZ      AR3     ;salt daca A=0
879A'  47               MOV     B,A
879B'  CD 20A0'          CALL    A24     ;CHL=CHL+256*B*DE
879E'  3A 201C  AR3:    LDA     D3
87A1'  47               MOV     B,A     ;B=D3(low)
87A2'  AF               XRA     A       ;A=0
87A3'  CD 2081'          CALL    I24     ;CHL=CHL+B*ADE
87A6'  EB               XCHG
```

```
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87A7'  2A 2030                   LHLD   RK2
87AA'  EB                        XCHG           ;DE=rk2
87AB'  3A 201F                   LDA    D4+1    ;A=D4(high)
87AE'  B7                        ORA    A
87AF'  CA 87B6'                  JZ     AR5     ;salt daca A=0
87B2'  47                AR4:    MOV    B,A
87B3'  CD 209D'                  CALL   A2M     ;CHL=CHL-256*B*DE
87B6'  3A 201E           AR5:    LDA    D4
87B9'  47                        MOV    B,A     ;B=D4(low)
87BA'  EB                        XCHG
87BB'  2A 2030                   LHLD   RK2
87BE'  EB                        XCHG           ;DE=rk2
87BF'  CD 207A'                  CALL   I2M     ;CHL=CHL-B*ADE
                                 ;               in CHL  se afla rezultatul
87C2'  E5                        PUSH   H
87C3'  2A 2028                   LHLD   WK
87C6'  22 202A                   SHLD   W1      ;w1=wk
87C9'  2A 202E                   LHLD   RK1
87CC'  22 2030                   SHLD   RK2     ;rk2=rk1
87CF'  2A 202C                   LHLD   RK
87D2'  22 202E                   SHLD   RK1     ;rk1=rk
87D5'  E1                        POP    H
87D6'  79                        MOV    A,C
87D7'  B7                        ORA    A
87D8'  FA 87EF'                  JM     AR6     ;salt daca C<0
87DB'  C2 87E4'                  JNZ    AR7-3   ;salt daca C>0
87DE'  3E 77                     MVI    A,77H   ;C=0
87E0'  BC                        CMP    H
87E1'  D2 87E7'                  JNC    AR7     ;salt daca H<=77H
87E4'  21 77F0                   LXI    H,77F0H ;corectie depasire superioara
87E7'  22 2020           AR7:    SHLD   YK      ;yk=HL
87EA'  AF                        XRA    A
87EB'  32 2024                   STA    YS      ;ys=0
87EE'  C9                        RET
87EF'  3C                AR6:    INR    A
87F0'  C2 87F9'                  JNZ    AR8-3   ;salt daca C<255
87F3'  3E 87                     MVI    A,87H
87F5'  BC                        CMP    H
87F6'  DA 87FC'                  JC     AR8     ;salt daca H>87H
87F9'  21 8810                   LXI    H,8810H ;corectie depasire inferioara
87FC'  22 2020           AR8:    SHLD   YK      ;yk=HL
87FF'  3E FF                     MVI    A,255
8801'  32 2024                   STA    YS      ;ys=255
8804'  3E 0B                     MVI    A,11    ;este validata RST 7.5
8806'  30                        DB     30H     ;aceasta este instructiunea S
8807'  C9                        RET
                         ;
                         ;                      Subrutina SBR2 (etapa de comanda)
                         ;
8808'  7C               SBR2:   MOV    A,H
8809'  E6 3F                     ANI    3FH     ;mascare pe 14 biti
880B'  C6 80                     ADI    80H     ;mod de lucru 2
880D'  D3 2D                     OUT    2DH     ;TIMER high
880F'  7D                        MOV    A,L
8810'  D3 2C                     OUT    2CH     ;TIMER low
8812'  AF                        XRA    A
```

```
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8813'   32 2034                 STA     BYTE    ;BYTE=0
8816'   3E 0B                   MVI     A,11    ;validare RST7.5
8818'   30                      DB      30H     ;aceasta este instructiunea SIM
8819'   3E C1                   MVI     A,0C1H
881B'   D3 28                   OUT     28H     ;start TIMER
881D'   76                      HLT
881E'   C9                      RET
                                PAGE
```

```
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                                ;
                                ;               Subrutina de inmultire pe 24 biti
                                ;
                                        ORG     K+3     ;in RAM-ul static
207A'   CD 20AB'               I2M:    CALL    AIN     ;DE=-DE
207D'   3E 00                           MVI     A,0
207F'   CE FF                           ACI     255
                                ;
2081'   E5                      I24:    PUSH    H
2082'   2E 08                           MVI     L,8
2084'   E3                      I22:    XTHL
2085'   F5                              PUSH    PSW
2086'   78                              MOV     A,B
2087'   1F                              RAR
2088'   47                              MOV     B,A
2089'   D2 2091'                        JNC     I23
208C'   F1                              POP     PSW
208D'   19                              DAD     D
208E'   F5                              PUSH    PSW
208F'   89                              ADC     C
2090'   4F                              MOV     C,A
2091'   F1                      I23:    POP     PSW
2092'   EB                              XCHG
2093'   29                              DAD     H
2094'   8F                              ADC     A
2095'   EB                              XCHG
2096'   E3                              XTHL
2097'   2D                              DCR     L
2098'   C2 2084'                        JNZ     I22
209B'   E1                              POP     H
209C'   C9                              RET             ;CHL=CHL+B*ADE
                                ;
                                ;               Subrutina de inmultire, prin
                                ;               adunari repetate, pe 24 biti
                                ;
209D'   CD 20AB'                A2M:    CALL    AIN     ;DE=-DE
                                ;
20A0'   7C                      A24:    MOV     A,H
20A1'   83                              ADD     E
20A2'   67                              MOV     H,A     ;H=H+E
20A3'   79                              MOV     A,C
20A4'   8A                              ADC     D
20A5'   4F                              MOV     C,A     ;C=C+D+CY
                                ;
20A6'   05                              DCR     B       ;repeta de B ori
20A7'   C2 20A0'                        JNZ     A24     ;CHL=CHL+256*B*DDE
20AA'   C9                              RET
                                ;
                                ;               Subruttina pentru complementarea DE,
                                ;               cu posibilitata de complementare pe
                                ;               24 biti
                                ;
20AB'   7A                      AIN:    MOV     A,D
20AC'   2F                              CMA
```

```
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20AD'   57                               MOV     D,A
20AE'   7B                               MOV     A,E
20AF'   2F                               CMA
20B0'   5F                               MOV     E,A
20B1'   B7                               ORA     A
20B2'   1C                               INR     E
20B3'   C0                               RNZ             ;CY=0
20B4'   14                               INR     D
20B5'   C0                               RNZ             ;CY=0
20B6'   37                               STC             ;CY=1
20B7'   C9                               RET
                                         PAGE
```

```
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                                ;
                                ;               Preluarea prescrierii de la DAF
                                ;
20B8'                           T:      ORG     SBR2+30
8826'   3A 2035                        LDA     FAN
8829'   B7                              ORA     A
882A'   CA 8630'                       JZ      TT      ;salt daca FAN=0
882D'   AF                              XRA     A
882E'   32 2035                        STA     FAN     ;FAN=0
8831'   01 2036                        LXI     B,ADIN
8834'   21 2036                        LXI     H,ADIN
8837'   22 2016                        SHLD    ADAD
883A'   CD 4534                        CALL    4534H   ;conversie
                                                        ;(zecimal ASCII) - (hexa)
883D'   E5                              PUSH    H
883E'   22 2028                        SHLD    WK      ;wk=w(DAF)
8841'   7C                              MOV     A,H
8842'   CD 456D                        CALL    HOUT    ;ecou wk (high)
8845'   E1                              POP     H
8846'   7D                              MOV     A,L
8847'   CD 456D                        CALL    HOUT    ;ecou wk (low)
884A'   3E 48                          MVI     A,'H'
884C'   CD 4437                        CALL    OU      ;ecou caracter 'H'
884F'   CD 4441                        CALL    4441H   ;CR,LF
8852'   C3 8630'                       JMP     TT
                                ;
                                        END
```

Macros:

Symbols:

20A0'	A24	209D'	A2M	2016	ADAD
2036	ADIN	20AB'	AIN	877E'	AR1
8782'	AR2	879E'	AR3	87B2'	AR4
87B6'	AR5	87EF'	AR6	87E7'	AR7
87FC'	AR8	8753'	ARN	2034	BYTE
205F'	CP1	2062'	CP2	206E'	CP3
2018	D0	2019	D1	201A	D2
201C	D3	201E	D4	8734'	ED1
871D'	ED2	872F'	ED3	2035	FAN
456D	HOUT	2084'	I22	2091'	I23
2081'	I24	207A'	I2M	20D1'	IT
2077'	K	4437	OU	207A'	PP1
8912'	PP2	892F'	PP3	893A'	PP4
202C	RK	202E	RK1	2030	RK2
8743'	SBR1	8808'	SBR2	20B8'	T
8630'	TT	202A	W1	2028	WK
2020	YK	2022	YK1	2024	YS
2025	YS1	2026	YT		

No Fatal error(s)

ANEXA A4

PROGRAM DE REGLARE NUMERICA A VITEZEI PENTRU TREI SISTEME DE ACTIONARE CU MOTOR DE CURENT CONTINUU INDEPENDENTE COMANDATE DE UN SINGUR MICROPROCESOR UZUAL

```
0000'   09                   R;          ------------------------------------------
                             ;           I   PROGRAM PENTRU REGLAREA VITEZEI      I
                             ;           I    A 3 MOTOARE DE C.C.CU UN            I
                             ;           I    SINGUR MICROPROCESOR DE COMANDA     I
                             ;           ------------------------------------------
                             ;zona de date
                             ;
0000'                                DSEG
283E                         TABI    EQU     283EH   ;inceput tabel intreruperi
2852                         TABC    EQU     2852H   ;inceput tabel calcul
2876                         CCR     EQU     2876H   ;contor caractere receptionate
2877                         NRMOT   EQU     2877H   ;nr.motor
2878                         VITPR   EQU     2878H   ;viteza prescrisa
287A                         SVIT    EQU     287AH   ;sensul vitezei
287B                         VPRN    EQU     287BH   ;vector pornire
287C                         SEMN    EQU     287CH   ;variabila de legatura subr.
                                                     ;in progr.de calcul
287D                         ADRTAB  EQU     287DH   ;contor adresa tabel
                                                     ;intreruperi
00F6                         MSKA    EQU     0F6H    ;masca pentru motor 1
00ED                         MSKB    EQU     0EDH    ;masca pentru motor 2
00DB                         MSKC    EQU     0DBH    ;masca pentru motor 3
287E                         COCC    EQU     287EH   ;contor intr.oprire chopper
                                     PAGE
```

```
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                                ;
0000"                                   DSEG
                                ;
                                ;salt subr.intr.RST 7.5
                                        ORG     20CEH
20CE"   C3 288A"                        JMP     ITIM
                                ;tabel subr.numarare
                                        ORG     2800H
2800"   C3 2883"                        JMP     NUM
                                        ORG     2808H
2808"   04                              INR     B
2809"   C3 2883"                        JMP     NUM
                                        ORG     2810H
2810"   0C                              INR     C
2811"   C3 2883"                        JMP     NUM
                                        ORG     2818H
2818"   04                              INR     B
2819"   0C                              INR     C
281A"   C3 2883"                        JMP     NUM
                                        ORG     2820H
2820"   14                              INR     D
2821"   C3 2883"                        JMP     NUM
                                        ORG     2828H
2828"   04                              INR     B
2829"   14                              INR     D
282A"   C3 2883"                        JMP     NUM
                                        ORG     2830H
2830"   0C                              INR     C
2831"   14                              INR     D
2832"   C3 2883"                        JMP     NUM
                                        ORG     2838H
2838"   04                              INR     B
2839"   0C                              INR     C
283A"   14                              INR     D
283B"   C3 2883"                        JMP     NUM
                                ;subprogram pornire
283E"                           START:  ORG     9000H
9000"   3E 00                            MVI     A,00H ;adr.subr.intr.RST 6.5
9002"   32 20C9                          STA     20C9H ;  low
9005"   3E 88                            MVI     A,88H
9007"   32 20CA                          STA     20CAH ;  high
900A"   31 0000                          LXI     SP,0  ;initializare stiva
900D"   3E 0C                            MVI     A,0CH ;programare porturi 8155
900F"   D3 20                            OUT     20H
9011"   21 283E                          LXI     H,TABI;initializare tabele &
                                                      ;variabile
9014"   0E 38                            MVI     C,56
9016"   AF                              XRA     A
9017"   77                      ST1:    MOV     M,A
9018"   2C                              INR     L
9019"   0D                              DCR     C
901A"   C2 9017"                        JNZ     ST1
901D"   3E 3C                          MVI     A,3CH
901F"   32 284F                        STA     TABI+17
```

```
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9022"  3E 01                    MVI     A,1
9024"  32 284C                  STA     TABI+14
9027"  3E 03                    MVI     A,3
9029"  32 2850                  STA     TABI+18
902C"  AF                       XRA     A
902D"  32 287B                  STA     VPRN
9030"  3E 4A                    MVI     A,4AH
9032"  32 287D                  STA     ADRTAB
9035"  3E 3C                    MVI     A,3CH   ;programare timer 5 ms
9037"  D3 2D                    OUT     2DH
9039"  AF                       XRA     A
903A"  D3 2C                    OUT     2CH
903C"  32 2876                  STA     CCR
903F"  C3 9047"                 JMP     INI1
                        ;program principal
9042"  3E 3E            INIT:  MVI     A,3EH   ;initializare ADRTAB
9044"  32 287D                  STA     ADRTAB
9047"  01 0000          INI1:  LXI     B,0     ;initializare contoare
904A"  11 0000                  LXI     D,0
904D"  3E 0B                    MVI     A,0BH   ;validare intr.RST 7.5
904F"  30                       DB      30H     ;codul instr.SIM pentru 8085
9050"  3A 287B                  LDA     VPRN
9053"  D3 23                    OUT     23H     ;start chopper
9055"  3E C0                    MVI     A,0C0H
9057"  D3 28                    OUT     28H     ;start timer
9059"  FB            EINIT:    EI
905A"  C3 905D"                 JMP     NUMR
                        ;subrutina numarare
905D"                   NUMR:  ORG     287FH
287F"  26 28                    MVI     H,28H
2881"  1E 00                    MVI     E,0
2883"  DB 21            NUM:   IN      21H
2885"  6F                      MOV     L,A
2886"  AB                      XRA     E
2887"  5D                      MOV     E,L
2888"  6F                      MOV     L,A
2889"  E9            ENUMR:    PCHL
                               PAGE
```

```
                                ;subr.tratare intr.RST 7.5 (timer)
288A"  F5                       ITIM:   PUSH    PSW
288B"  E5                               PUSH    H
288C"  3A 287D                          LDA     ADRTAB
288F"  C6 04                            ADI     4
2891"  6F                               MOV     L,A
2892"  32 287D                          STA     ADRTAB
2895"  26 28                            MVI     H,28H   ;(HL)=adr.(const.timer low)
                                                        ;pt.cuanta urmatoare
2897"  7E                               MOV     A,M
2898"  D3 2C                            OUT     2CH     ;incarcare timer
289A"  2C                               INR     L
289B"  7E                               MOV     A,M
289C"  D3 2D                            OUT     2DH
289E"  2D                               DCR     L
289F"  2D                               DCR     L
28A0"  2D                               DCR     L       ;(HL)=adr.(cod intr.)
                                                        ;pt.cuanta curenta
28A1"  7E                               MOV     A,M
28A2"  2C                               INR     L
28A3"  1F                               RAR             ;testare IOC sau ITNC
28A4"  DA 28D0"                         JC      ITNC
28A7"  F5                       IOC:    PUSH    PSW
28A8"  66                               MOV     H,M     ;stop chopper
28A9"  DB 23                            IN      23H
28AB"  A4                               ANA     H
28AC"  D3 23                            OUT     23H
28AE"  F1                               POP     PSW
28AF"  1F                               RAR             ;testare IOCN sau IOCC
28B0"  DA 28C5"                         JC      RCALC
28B3"  26 06                    RNUM:   MVI     H,6     ;intr.IOCN
28B5"  33                       RN1:    INX     SP
28B6"  25                               DCR     H
28B7"  C2 28B5"                         JNZ     RN1     ;6xINX SP
28BA"  3E 0B                            MVI     A,0BH   ;validare intr RST 7.5
28BC"  30                               DB      30H     ;codul instr. SIM pentru 8085
28BD"  FB                               EI
28BE"  3E C0                            MVI     A,0C0H  ;start timer
28C0"  D3 28                            OUT     28H
28C2"  C3 905D"                         JMP     NUMR
28C5"  E1                       RCALC:  POP     H       ;intr.IOCC
28C6"  3E 09                            MVI     A,9     ;valid.intr.RST 6.5,RST 7.5
28C8"  30                               DB      30H     ;codul instr.SIM pentru 8085
28C9"  3E C0                            MVI     A,0C0H  ;start timer
28CB"  D3 28                            OUT     28H
28CD"  F1                               POP     PSW
28CE"  FB                               EI
28CF"  C9                               RET
28D0"  26 06                    ITNC:   MVI     H,6     ;intr.ITN sau ITC
28D2"  33                       IT1:    INX     SP
28D3"  25                               DCR     H
28D4"  C2 28D2"                         JNZ     IT1
28D7"  1F                               RAR             ;testare ITN sau ITC
28D8"  DA 28E2"                         JC      ITC
```

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```
28DB"  3E C0              ITN:   MVI    A,0C0H  ;intr.ITN
28DD"  D3 28                     OUT    28H     ;start timer
28DF"  C3 88F0"                  JMP    CALC
28E2"  2A 283E            ITC:   LHLD   TABI    ;intr.ITC
28E5"  7D                        MOV    A,L     ;incarcare timer cu const.
                                                ;pt.primul interval
28E6"  D3 2C                     OUT    2CH     ;de temporizare din cuanta
                                                ;urmatoare
28E8"  7C                        MOV    A,H
28E9"  D3 2D                     OUT    2DH
28EB"  C3 9042"           EITIM: JMP    INIT
                                 PAGE
```

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```
                                ;subr.tratare intr.RST 6.5 (DAF)
28EE"                           DIAL:   ORG     8800H
8800"   F5                              PUSH    PSW
8801"   C5                              PUSH    B
8802"   D5                              PUSH    D
8803"   E5                              PUSH    H
8804"   3A 7000                         LDA     7000H
8807"   CD 4336                         CALL    4336H   ;preluare caracter de la DAF
                                                        ;in reg.B
880A"   0E 19                          MVI     C,25    ;intirziere pentru dialogul
                                                        ;cu DAF-ul
880C"   0D                      DIO:    DCR     C       ;testare CCR
880D"   C2 880C"                        JNZ     DIO
8810"   3A 2876                         LDA     CCR
8813"   B7                              ORA     A
8814"   CA 882A"                        JZ      DIA0
8817"   3D                              DCR     A
8818"   CA 8854"                        JZ      DIA1
881B"   3D                              DCR     A
881C"   CA 8866"                        JZ      DIA2
881F"   3D                              DCR     A
8820"   CA 8882"                        JZ      DIA3
8823"   3D                              DCR     A
8824"   CA 8893"                        JZ      DIA4
8827"   C3 88DB"                        JMP     DHLT
882A"   78                      DIA0:   MOV     A,B     ;CCR=0
882B"   FE 2B                          CPI     '+'
882D"   CA 883D"                        JZ      DIO1
8830"   FE 2D                          CPI     '-'
8832"   CA 884C"                        JZ      DIO2
8835"   FE 18                          CPI     24      ;ecou <CLEAR>
8837"   CC 88E4"                        CZ      DAF
883A"   C3 88DB"                        JMP     DHLT
883D"   CD 88E4"                DIO1:   CALL    DAF
8840"   AF                              XRA     A       ;SVIT=0 pt. '+'
8841"   32 287A                 DIO3:   STA     SVIT
8844"   3E 01                           MVI     A,1
8846"   32 2876                         STA     CCR     ;pune CCR=1
8849"   C3 88DB"                        JMP     DHLT
884C"   CD 88E4"                DIO2:   CALL    DAF
884F"   3E 01                           MVI     A,1     ;SVIT=1 pt. '-'
8851"   C3 8841"                        JMP     DIO3
8854"   78                      DIA1:   MOV     A,B     ;CCR=1
8855"   CD 88E4"                        CALL    DAF     ;afisare reg.A(ASCII)
8858"   CD 4565                         CALL    4565H   ;conversie A(ASCII) ->
                                                        ;A(HEXA)
885B"   32 2878                         STA     VITPR   ;stocare temporara cifra I
885E"   3E 02                           MVI     A,2
8860"   32 2876                         STA     CCR     ;pune   CCR=2
8863"   C3 88DB"                        JMP     DHLT
8866"   78                      DIA2:   MOV     A,B     ;CCR=2
8867"   CD 88E4"                        CALL    DAF
886A"   CD 4565                         CALL    4565H
886D"   47                              MOV     B,A     ;(B)=cifra a II-a
```

```
886E"  3A 2878                    LDA     VITPR   ;(A)=cifra I
8871"  B7                         ORA     A
8872"  17                         RAL
8873"  17                         RAL
8874"  17                         RAL
8875"  17                         RAL
8876"  B0                         ORA     B       ;concatenare cifre
8877"  32 2878                    STA     VITPR
887A"  3E 03                      MVI     A,3
887C"  32 2876                    STA     CCR     ;pune CCR=3
887F"  C3 88DB"                   JMP     DHLT
8882"  78                  DIA3:  MOV     A,B     ;CCR=3
8883"  FE 2F                      CPI     '/'     ;accepta numai '/'
8885"  C2 88DB"                   JNZ     DHLT
8888"  CD 88E4"                   CALL    DAF
888B"  3E 04                      MVI     A,4
888D"  32 2876                    STA     CCR     ;pune CCR=4
8890"  C3 88DB"                   JMP     DHLT
8893"  78                  DIA4:  MOV     A,B     ;CCR=4
8894"  CD 4565                    CALL    4565H   ;conversie A(ASCII) ->
                                                  ;A(HEXA)
8897"  3D                         DCR     A       ;verificare nr.motor = 1,2,3
8898"  FA 88DB"                   JM      DHLT
889B"  FE 03                      CPI     3
889D"  D2 88DB"                   JNC     DHLT
88A0"  3C                         INR     A       ;(A)=nr.motor
88A1"  F5                         PUSH    PSW
88A2"  78                         MOV     A,B
88A3"  CD 88E4"                   CALL    DAF     ;ecou
88A6"  CD 4441                    CALL    4441H   ;transmite la DAF <CR>,<LF>
88A9"  F1                         POP     PSW
88AA"  32 2877                    STA     NRMOT
88AD"  47                         MOV     B,A
88AE"  3E 80                      MVI     A,80H   ;constructie masti
88B0"  07                  DI40:  RLC
88B1"  05                         DCR     B
88B2"  C2 88B0"                   JNZ     DI40
88B5"  47                         MOV     B,A     ;masca pornire inainte
                                                  ;(de baza)
88B6"  3A 287A                    LDA     SVIT
88B9"  B7                         ORA     A       ;testare sens rotatie
88BA"  C2 88C6"                   JNZ     DI41
88BD"  78                         MOV     A,B     ;masca pornire inainte
88BE"  07                         RLC
88BF"  07                         RLC
88C0"  07                         RLC
88C1"  2F                         CMA
88C2"  4F                         MOV     C,A     ;masca oprire inainte
88C3"  C3 88CE"                   JMP     DI42
88C6"  78                  DI41:  MOV     A,B     ;masca pornire  inainte
88C7"  2F                         CMA
88C8"  4F                         MOV     C,A     ;masca oprire inapoi
88C9"  2F                         CMA
88CA"  17                         RAL
88CB"  17                         RAL
88CC"  17                         RAL
```

```
88CD"  47                        MOV   B,A     ;masca pornire inapoi
88CE"  3A 287B            DI42:  LDA   VPRN    ;mascare vector pornire
88D1"  A1                        ANA   C
88D2"  B0                        ORA   B
88D3"  32 287B                   STA   VPRN
88D6"  3E 05                     MVI   A,5
88D8"  32 2876                   STA   CCR     ;pune CCR=5
88DB"  3E 09              DHLT:  MVI   A,9     ;validare intr. RST 6.5,
                                               ;RST 7.5
88DD"  30                        DB    30H     ;codul instr.SIM pentru 8085
88DE"  E1                        POP   H
88DF"  D1                        POP   D
88E0"  C1                        POP   B
88E1"  F1                        POP   PSW
88E2"  FB                        EI
88E3"  C9                        RET
88E4"  F5                 DAF:   PUSH  PSW     ;subr.ecou
88E5"  0E 19                     MVI   C,25    ;temporizare
88E7"  0D                 DAF1:  DCR   C
88E8"  C2 88E7"                  JNZ   DAF1
88EB"  CD 4437                   CALL  4437H   ;transmite la DAF A(ASCII)
88EE"  F1                        POP   PSW
88EF"  C9                        RET
                                 PAGE
```

```
                                ;subrutina calcule
                                ;**** completare tabel calcule
88F0"                           CALC:   ORG     EINIT+1
905A"   3E 09                           MVI     A,9     ;validare intr.RST 6.5,RST 7.5
905C"   30                              DB      30H     ;codul instr.SIM pentru 8085
905D"   FB                              EI
905E"   C5                      CLC1:   PUSH    B       ;actualizare variabile:y(k-1),
905F"   D5                              PUSH    D       ; sr(k-1),sw(k-1),r(k-1),w(k-1
9060"   21 2852                         LXI     H,TABC
9063"   11 2858                         LXI     D,TABC+6
9066"   06 03                           MVI     B,3     ;repetare 3x
9068"   0E 06                   CL11:   MVI     C,6     ;repetare 6x
906A"   7E                      CL12:   MOV     A,M
906B"   12                              STAX    D
906C"   2C                              INR     L
906D"   1C                              INR     E
906E"   0D                              DCR     C
906F"   C2 906A"                        JNZ     CL12
9072"   7D                              MOV     A,L
9073"   C6 06                           ADI     6
9075"   6F                              MOV     L,A
9076"   7B                              MOV     A,E
9077"   C6 06                           ADI     6
9079"   5F                              MOV     E,A
907A"   05                              DCR     B
907B"   C2 9068"                        JNZ     CL11
907E"   D1                              POP     D
907F"   C1                              POP     B
9080"   78                              MOV     A,B
9081"   32 2856                         STA     TABC+4  ;pune in tabel r(k) de la
                                                        ;subr. de numarare
9084"   79                              MOV     A,C
9085"   32 2862                         STA     TABC+16
9088"   7A                              MOV     A,D
9089"   32 2864                         STA     TABC+18
908C"   DB 22                           IN      22H     ;citire semsuri de rotatie
                                                        ;de la TIRO
908E"   47                              MOV     B,A
908F"   E6 01                           ANI     1
9091"   32 2854                         STA     TABC+2  ;pune in tabel sr(k)
9094"   78                              MOV     A,B
9095"   1F                              RAR
9096"   47                              MOV     B,A
9097"   E6 01                           ANI     1
9099"   32 2860                         STA     TABC+14
909C"   78                              MOV     A,B
909D"   1F                              RAR
909E"   E6 01                           ANI     1
90A0"   32 286C                         STA     TABC+26
90A3"   3A 2876                         LDA     CCR
90A6"   FE 05                           CPI     5       ;testare receptie completa
                                                        ;(CCR=5)
90A8"   C2 90C7"                        JNZ     CLC2
90AB"   AF                              XRA     A       ;CY=0
```

```
90AC"  3A 2877                    LDA     NRMOT   ;calcul adr[sw(k)]
90AF"  17                         RAL
90B0"  17                         RAL
90B1"  47                         MOV     B,A
90B2"  17                         RAL
90B3"  80                         ADD     B
90B4"  21 2849                    LXI     H,TABC-9
90B7"  85                         ADD     L
90B8"  6F                         MOV     L,A     ;(HL)=TABC-9+12*NRMOT=
                                                  ;adr[sw(k)]
90B9"  3A 287A                    LDA     SVIT
90BC"  77                         MOV     M,A     ;pune in tabel sw(k)
90BD"  2C                         INR     L
90BE"  2C                         INR     L       ;(HL)=adr[w(k)]
90BF"  3A 2878                    LDA     VITPR
90C2"  77                         MOV     M,A     ;pune in tabel w(k)
90C3"  AF                         XRA     A
90C4"  32 2876                    STA     CCR     ;pune CCR=0
                          ;****calcul y(k)
90C7"  21 2852            CLC2:   LXI     H,TABC
90CA"  3E 03                      MVI     A,3     ;repetare de 3x calcul
90CC"  F5                 CL14:   PUSH    PSW
90CD"  7D                         MOV     A,L
90CE"  C6 06                      ADI     6
90D0"  6F                         MOV     L,A
90D1"  5E                         MOV     E,M
90D2"  2C                         INR     L
90D3"  56                         MOV     D,M     ;(DE)=y(k-1)
90D4"  7D                         MOV     A,L
90D5"  DE 05                      SBI     5
90D7"  6F                         MOV     L,A     ;(HL)=adr[sr(k)]
90D8"  CD 920B"                   CALL    DIF     ;(A)=|w(k)-r(k)|
90DB"  CD 9248"                   CALL    MLT1    ;(A)=y(k-1)+/-378*|w(k)-r(k)|
90DE"  2C                         INR     L
90DF"  2C                         INR     L
90E0"  2C                         INR     L       ;(HL)=adr[sr(k-1)]
90E1"  CD 920B"                   CALL    DIF     ;(A)=|w(k-1)-r(k-1)|
90E4"  CD 929D"                   CALL    MLT2    ;(DE)=y(k-1)+/-378*|w(k)-r(k)
                                                  ;-/+353*|w(k-1)-r(k-1)|
90E7"  7D                         MOV     A,L     ;(HL)=adr[w(k-1)]
90E8"  D6 0B                      SUI     11
90EA"  6F                         MOV     L,A     ;(HL)=adr[y(k)low]
90EB"  73                         MOV     M,E     ;pune in tabel y(k)
90EC"  2C                         INR     L
90ED"  72                         MOV     M,D
90EE"  7D                         MOV     A,L
90EF"  C6 0B                      ADI     11
90F1"  6F                         MOV     L,A     ;(HL)=adr[y(k)] pt.motorul ur
90F2"  F1                         POP     PSW
90F3"  3D                         DCR     A       ;contor 3x
90F4"  C2 90CC"                   JNZ     CL14
                          ;****compara & ordoneaza in stiva y(k)
90F7"  2A 2852            COMP:   LHLD    TABC
90FA"  44                         MOV     B,H
90FB"  4D                         MOV     C,L     ;y(k)pt.mot.1 -> BC
90FC"  2A 285E                    LHLD    TABC+12
```

```
90FF"  EB                        XCHG            ;y(k)pt.mot.2 -> DE
9100"  2A 286A                   LHLD    TABC+24 ;y(k)pt.mot.3 -> HL
9103"  7A                CMP0:   MOV     A,D
9104"  BC                        CMP     H       ;ordinea in stiva va fi:
9105"  DA 9153"                  JC      CMP1    ;       MSK (maxim)
9108"  C2 9110"                  JNZ     CMP6    ;       y(k) maxim
910B"  7B                        MOV     A,E     ;       MSK (intermediar)
910C"  BD                        CMP     L       ;       y(k) intermediar
910D"  DA 9153"                  JC      CMP1    ;       MSK (minim)
9110"  78                CMP6:   MOV     A,B     ;       y(k) minim
9111"  BA                        CMP     D
9112"  DA 912C"                  JC      CMP2
9115"  C2 911D"                  JNZ     CMP7
9118"  7D                        MOV     A,L
9119"  BB                        CMP     E
911A"  DA 912C"                  JC      CMP2
911D"  3E F6              CMP7:   MVI     A,MSKA
911F"  F5                        PUSH    PSW
9120"  C5                        PUSH    B
9121"  3E ED                     MVI     A,MSKB
9123"  F5                        PUSH    PSW
9124"  D5                        PUSH    D
9125"  3E DB                     MVI     A,MSKC
9127"  F5                        PUSH    PSW
9128"  E5                        PUSH    H
9129"  C3 9193"                  JMP     CONST
912C"  3E ED              CMP2:   MVI     A,MSKB
912E"  F5                        PUSH    PSW
912F"  D5                        PUSH    D
9130"  78                        MOV     A,B
9131"  BC                        CMP     H
9132"  DA 9148"                  JC      CMP4
9135"  C2 913D"                  JNZ     CMP8
9138"  79                        MOV     A,C
9139"  BD                        CMP     L
913A"  DA 9148"                  JC      CMP4
913D"  3E F6              CMP8:   MVI     A,MSKA
913F"  F5                        PUSH    PSW
9140"  C5                        PUSH    B
9141"  3E DB                     MVI     A,MSKC
9143"  F5                        PUSH    PSW
9144"  E5                        PUSH    H
9145"  C3 9193"                  JMP     CONST
9148"  3E DB              CMP4:   MVI     A,MSKC
914A"  F5                        PUSH    PSW
914B"  E5                        PUSH    H
914C"  3E F6                     MVI     A,MSKA
914E"  F5                        PUSH    PSW
914F"  C5                        PUSH    B
9150"  C3 9193"                  JMP     CONST
9153"  78                CMP1:   MOV     A,B
9154"  BC                        CMP     H
9155"  DA 915F"                  JC      CMP3
9158"  C2 9160"                  JNZ     CMP9
915B"  79                        MOV     A,C
915C"  BD                        CMP     L
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```
915D"  DA 916F"                    JC      CMP3
9160"  3E F6               CMP9:   MVI     A,MSKA
9162"  F5                         PUSH    PSW
9163"  C5                         PUSH    B
9164"  3E DB                      MVI     A,MSKC
9166"  F5                         PUSH    PSW
9167"  E5                         PUSH    H
9168"  3E ED                      MVI     A,MSKB
916A"  F5                         PUSH    PSW
916B"  D5                         PUSH    D
916C"  C3 9193"                   JMP     CONST
916F"  3E DB               CMP3:   MVI     A,MSKC
9171"  F5                         PUSH    PSW
9172"  E5                         PUSH    H
9173"  78                         MOV     A,B
9174"  BA                         CMP     D
9175"  DA 918B"                   JC      CMP5
9178"  C2 9180"                   JNZ     CMP10
917B"  7D                         MOV     A,L
917C"  BB                         CMP     E
917D"  DA 918B"                   JC      CMP5
9180"  3E F6               CMP10:  MVI     A,MSKA
9182"  F5                         PUSH    PSW
9183"  C5                         PUSH    B
9184"  3E ED                      MVI     A,MSKB
9186"  F5                         PUSH    PSW
9187"  D5                         PUSH    D
9188"  C3 9193"                   JMP     CONST
918B"  3E ED               CMP5:   MVI     A,MSKB
918D"  F5                         PUSH    PSW
918E"  D5                         PUSH    D
918F"  3E F6                      MVI     A,MSKA
9191"  F5                         PUSH    PSW
9192"  C5                         PUSH    B
                          ;**** constructie tabel intreruperi
9193"  21 283E             CONST:  LXI     H,TABI
9196"  01 0000                     LXI     B,0
9199"  3E 03                      MVI     A,3
919B"  32 287E                    STA     COCC    ;COCC=3
919E"  D1                  CONS1:  POP     D
919F"  D5                         PUSH    D       ;scoate y(k) in DE
91A0"  7A                         MOV     A,D
91A1"  FE 3C                      CPI     3CH     ;(DE) > 3C00H ?
91A3"  D2 91BA"                   JNC     CONS2
91A6"  CD 91F0"                   CALL    DIFY    ;calculeaza & pune in tabel d(k
91A9"  C1                         POP     B       ;viitor Y(k)*
91AA"  36 00                      MVI     M,0     ;cod ITC sau ITN
91AC"  2C                         INR     L
91AD"  F1                         POP     PSW
91AE"  77                         MOV     M,A     ;masca oprire
91AF"  2C                         INR     L
91B0"  3A 287E                    LDA     COCC    ;COCC=COCC-1
91B3"  3D                         DCR     A
91B4"  32 287E                    STA     COCC
91B7"  C2 919E"                   JNZ     CONS1
91BA"  11 3C00             CONS2:  LXI     D,3C00H ;const.pt.T/2 = 5ms
```

```
91BD"  CD 91F0"                    CALL    DIFY
91C0"  01 3C00                     LXI     B,3C00H ;viitor y(k)* = 5ms
91C3"  36 01                       MVI     M,1     ;cod ITN
91C5"  2C                          INR     L
91C6"  2C                          INR     L       ;nu se pune masca de oprire
91C7"  3A 287E              CONS3: LDA     COCC
91CA"  B7                          ORA     A
91CB"  CA 91E4"                    JZ      CONS4
91CE"  D1                          POP     D
91CF"  D5                          PUSH    D       ;scoate y(k) in DE
91D0"  CD 91F0"                    CALL    DIFY
91D3"  C1                          POP     B       ;viitor y(k)*
91D4"  36 02                       MVI     M,2     ;cod IOCC
91D6"  2C                          INR     L
91D7"  F1                          POP     PSW
91D8"  77                          MOV     M,A     ;masca oprire
91D9"  2C                          INR     L
91DA"  3A 287E                     LDA     COCC    ;COCC=COCC-1
91DD"  3D                          DCR     A
91DE"  32 287E                     STA     COCC
91E1"  C3 91C7"                    JMP     CONS3
91E4"  11 7800              CONS4: LXI     D,7800H ;const.pt.T=10ms
91E7"  CD 91F0"                    CALL    DIFY
91EA"  36 03                       MVI     M,3     ;cod ITC
91EC"  76                          HLT
91ED"  76                          HLT
91EE"  76                          HLT
91EF"  76                          HLT
91F0"  7B                   DIFY:  MOV     A,E     ;subr.calcul d(k)=DE-BC
91F1"  91                          SUB     C
91F2"  5F                          MOV     E,A
91F3"  7A                          MOV     A,D
91F4"  98                          SBB     B
91F5"  57                          MOV     D,A     ;DE=DE-BC
91F6"  DA 9202"                    JC      DIY1    ;limitare inferioara:DE>=30
91F9"  C2 9206"                    JNZ     DIY2
91FC"  7B                          MOV     A,3
91FD"  FE 1E                       CPI     30
91FF"  D2 9206"                    JNC     DIY2
9202"  1E 1E                DIY1:  MVI     E,30
9204"  16 00                       MVI     D,0
9206"  73                   DIY2:  MOV     M,E     ;pune d(k) in tabel intr.
9207"  2C                          INR     L
9208"  72                          MOV     M,D
9209"  2C                          INR     L
920A"  C9                          RET
                                   PAGE
```

```
                        ; subrutine matematice
                        ;**** scadere 1 octet (modul+semn)
920B"  AF               DIF:    XRA     A
920C"  32 287C                  STA     SEMN
920F"  46                       MOV     B,M     ;(B)=sr
9210"  23                       INX     H
9211"  7E                       MOV     A,M     ;(A)=sw
9212"  A8                       XRA     B
9213"  C2 9230"                 JNZ     DIF2
9216"  B0                       ORA     B       ;acelasi semn
9217"  23                       INX     H       ;w,r >0
9218"  46                       MOV     B,M
9219"  23                       INX     H
921A"  7E                       MOV     A,M
921B"  C2 922A"                 JNZ     DIF3
921E"  90                       SUB     B       ;(A)=|w|-|r|
921F"  D0               DIF4:   RNC
9220"  2F                       CMA
9221"  3C                       INR     A
9222"  47                       MOV     B,A
9223"  3E 01                    MVI     A,1
9225"  32 287C                  STA     SEMN
9228"  78                       MOV     A,B
9229"  C9                       RET
922A"  4F               DIF3:   MOV     C,A     ;w,r <0
922B"  78                       MOV     A,B
922C"  91                       SUB     C       ;(A)=|r|-|w|
922D"  C3 921F"                 JMP     DIF4
9230"  A8               DIF2:   XRA     B       ;semne diferite
9231"  23                       INX     H
9232"  46                       MOV     B,M
9233"  23                       INX     H
9234"  7E                       MOV     A,M
9235"  C2 923D"                 JNZ     DIF5
9238"  80                       ADD     B       ;w>0,r<0   (A)=|r|+|w|
9239"  D0               DIF6:   RNC
923A"  3E FF                    MVI     A,255   ;corectie
923C"  C9                       RET
923D"  80               DIF5:   ADD     B       ;w<0,r>0
923E"  47                       MOV     B,A
923F"  3E 01                    MVI     A,1
9241"  32 287C                  STA     SEMN
9244"  78                       MOV     A,B
9245"  C3 9239"                 JMP     DIF6
                        ;****(DE)=(DE)+/-378*(A)
9248"  D5               MLT1:   PUSH    D
9249"  47                       MOV     B,A
924A"  57                       MOV     D,A
924B"  B7                       ORA     A
924C"  1F                       RAR
924D"  5F                       MOV     E,A
924E"  3E 00                    MVI     A,0
9250"  1F                       RAR
9251"  4F                       MOV     C,A
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9252"  78                          MOV     A,B
9253"  83                          ADD     E
9254"  47                          MOV     B,A
9255"  7A                          MOV     A,D
9256"  B7                          ORA     A
9257"  17                          RAL
9258"  5F                          MOV     E,A
9259"  3E 00                       MVI     A,0
925B"  17                          RAL
925C"  57                          MOV     D,A
925D"  79                          MOV     A,C
925E"  93                          SUB     E
925F"  4F                          MOV     C,A
9260"  78                          MOV     A,B
9261"  9A                          SBB     D
9262"  47                          MOV     B,A
9263"  7B                          MOV     A,E
9264"  B7                          ORA     A
9265"  17                          RAL
9266"  5F                          MOV     E,A
9267"  7A                          MOV     A,D
9268"  17                          RAL
9269"  57                          MOV     D,A
926A"  79                          MOV     A,C
926B"  93                          SUB     E
926C"  4F                          MOV     C,A
926D"  78                          MOV     A,B
926E"  9A                          SBB     D
926F"  47                          MOV     B,A
9270"  D1                          POP     D       ;(BC)=378*(A)
9271"  78                          MOV     A,B
9272"  17                          RAL             ;test depasire la inmultire
9273"  DA 928A"                    JC      ML14
9276"  3A 287C                     LDA     SEMN
9279"  B7                          ORA     A
927A"  CA 9284"                    JZ      ML11
927D"  79                          MOV     A,C
927E"  2F                          CMA
927F"  4F                          MOV     C,A
9280"  78                          MOV     A,B
9281"  2F                          CMA
9282"  47                          MOV     B,A
9283"  03                          INX     B       ;(BC)=+/-378*(A)
                                                   ;(functie de SEMN)
9284"  EB                  ML11:   XCHG
9285"  09                          DAD     B
9286"  EB                          XCHG            ;(DE)=(DE)+/-378*(A)
9287"  D2 9295"                    JNC     ML12
928A"  3A 287C              ML14:   LDA     SEMN    ;depasire la adunare
928D"  B7                          ORA     A
928E"  CA 9299"                    JZ      ML13
9291"  11 0000                    LXI     D,0     ;limitare inferioara
9294"  C9                          RET
9295"  7A                  ML12:   MOV     A,D
9296"  FE 77                       CPI     77H
9298"  D8                          RC
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```
9299"  11 7700            ML13:  LXI   D,7700H ;limitare superiara
929C"  C9                        RET
                         ;**** (DE)=(DE)-(+/-353*(A))
929D"  D5                MLT2:  PUSH  D
929E"  47                       MOV   B,A
929F"  4F                       MOV   C,A
92A0"  B7                       ORA   A
92A1"  1F                       RAR
92A2"  5F                       MOV   E,A
92A3"  3E 00                    MVI   A,0
92A5"  1F                       RAR
92A6"  57                       MOV   D,A
92A7"  7B                       MOV   A,E
92A8"  1F                       RAR
92A9"  5F                       MOV   E,A
92AA"  7A                       MOV   A,D
92AB"  1F                       RAR
92AC"  57                       MOV   D,A
92AD"  81                       ADD   C
92AE"  4F                       MOV   C,A
92AF"  78                       MOV   A,B
92B0"  8B                       ADC   E
92B1"  47                       MOV   B,A
92B2"  B7                       ORA   A
92B3"  7B                       MOV   A,E
92B4"  1F                       RAR
92B5"  5F                       MOV   E,A
92B6"  7A                       MOV   A,D
92B7"  1F                       RAR
92B8"  81                       ADD   C
92B9"  4F                       MOV   C,A
92BA"  78                       MOV   A,B
92BB"  8B                       ADC   E
92BC"  47                       MOV   B,A      ;(BC)=353*(A)
92BD"  D1                       POP   D
92BE"  78                       MOV   A,B
92BF"  17                       RAL            ;test depasire inmultire
92C0"  DA 92D7"                 JC    ML24
92C3"  3A 287C                  LDA   SEMN
92C6"  B7                       ORA   A
92C7"  C2 92D1"                 JNZ   ML21
92CA"  79                       MOV   A,C
92CB"  2F                       CMA
92CC"  4F                       MOV   C,A
92CD"  78                       MOV   A,B
92CE"  2F                       CMA
92CF"  47                       MOV   B,A
92D0"  03                       INX   B        ;(BC)=-(+/-353*(A))
                                               ;(functie de SEMN)
92D1"  EB                ML21:  XCHG
92D2"  09                       DAD   B
92D3"  EB                       XCHG
92D4"  D2 92E2"                 JNC   ML22     ;(DE)=(DE)-(+/-353*(A))
                                               ;(functie de SEMN)
92D7"  3A 287C           ML24:  LDA   SEMN
92DA"  B7                       ORA   A
```

```
92DB"  C2 92E6"              JNZ     ML23
92DE"  11 0000               LXI     D,0     ;limitare inferioara
92E1"  C9                    RET
92E2"  7A              ML22: MOV     A,D
92E3"  FE 77                 CPI     77H
92E5"  D8                    RC
92E6"  11 7700         ML23: LXI     D,7700H ;limitare superioara
92E9"  C9                    RET
                             END
```

Macros:

Symbols:

287D	ADRTAB	88F0"	CALC	2876	CCR
9068"	CL11	906A"	CL12	90CC"	CL14
905E"	CLC1	90C7"	CLC2	9103"	CMP0
9153"	CMP1	9180"	CMP10	912C"	CMP2
916F"	CMP3	9148"	CMP4	918B"	CMP5
9110"	CMP6	911D"	CMP7	913D"	CMP8
9160"	CMP9	287E	COCC	90F7"	COMP
919E"	CONS1	91BA"	CONS2	91C7"	CONS3
91E4"	CONS4	9193"	CONST	88E4"	DAF
88E7"	DAF1	88DB"	DHLT	880C"	DIO
883D"	DIO1	884C"	DIO2	8841"	DIO3
88B0"	DI40	88C6"	DI41	88CE"	DI42
882A"	DIA0	8854"	DIA1	8866"	DIA2
8882"	DIA3	8893"	DIA4	28EE"	DIAL
920B"	DIF	9230"	DIF2	922A"	DIF3
921F"	DIF4	923D"	DIF5	9239"	DIF6
91F0"	DIFY	9202"	DIY1	9206"	DIY2
9059"	EINIT	28EB"	EITIM	2889"	ENUMR
9047"	INI1	9042"	INIT	28A7"	IOC
28D2"	IT1	28E2"	ITC	288A"	ITIM
28DB"	ITN	28D0"	ITNC	9284"	ML11
9295"	ML12	9299"	ML13	928A"	ML14
92D1"	ML21	92E2"	ML22	92E6"	ML23
92D7"	ML24	9248"	MLT1	929D"	MLT2
00F6	MSKA	00ED	MSKB	00DB	MSKC
2877	NRMOT	2883"	NUM	905D"	NUMR
28C5"	RCALC	28B5"	RN1	28B3"	RNUM
287C	SEMN	9017"	ST1	283E"	START
287A	SVIT	2852	TABC	283E	TABI
2878	VITPR	287B	VPRN		

No Fatal error(s)

ANEXA A5

PROGRAMELE DE SIMULARE PE CALCULATOR A METODEI DE REGLARE NUMERICA MODAL-ALUNECATOARE A POZITIEI APLICATA INTR-UN SISTEM DE ACTIONARE CU MOTOR DE CURENT CONTINUU

-A5.1. PROGRAM CU 92 DE PASI DE SIMULARE

-A5.2. PROGRAM CU 247 DE PASI DE SIMULARE

```
      PROGRAM simulare
      DIMENSION th(85),th1(85),s(85),u(85),v(85)
      REAL k1
C
C preluare Te
C
      WRITE(3,101)
101   FORMAT(1X,'Te=')
      READ(1,102) Te
102   FORMAT(F15.7)
C
C parametri PCE
C
      Ts=325.52E-9
      Ta=1.8E-3
      Tm=47.0E-3
      A=0.457
      d=0.1028
      a1=1/A
      a2=Tm/A
      a3=Tm*Ta/A
      Alfa=Te**2/4./d
C
C coeficienti simulare PCE
C
      div=8*Ta*Tm+4*Te*Tm+2*Te*Te
      Beta1=(24*Ta*Tm+4*Te*Tm-2*Te*Te)/div
      Beta2=(-24*Ta*Tm+4*Te*Tm+2*Te*Te)/div
      Beta3=(8*Ta*Tm-4*Te*Tm+2*Te*Te)/div
      Beta4=(A*Te**3)/div
C
C coeficienti estimator perturbatie
C
      k1=0.6
      Gama1=1/(1+k1)
      Gama2=k1*Gama1
C
C preluare treapta referinta
C
      WRITE(3,103)
103   FORMAT(1X,'w=')
      READ(1,102) w
C
C preluare perturbatie
C
      WRITE(3,104)
104   FORMAT(1X,'up=')
      READ(1,102) up
```

```
C
C introducere estimator perturbatii
C
      WRITE(3,105)
105   FORMAT(1X,'INTRODUCEREA ESTIMATORULUI DE PERTURBATII (C/1):')
      READ (3,106) Kpert
106   FORMAT(I2)
      WRITE(3,107)
C
C preluare tip PCE
C
107   FORMAT(1X,'TIP PCE (1/2):')
      READ(3,106) Kpce
C
C preluare tip ARMA
C
      WRITE(3,108)
108   FORMAT(1X,'TIP ARMA (1/2):')
      READ(3,106) Karma
      IF(Karma.EQ.2) GOTO 1001
C
C preluare coeficienti ARMA
C
      WRITE(3,109)
109   FORMAT(1X,'C=')
      READ(1,102) C
      GOTO 1002
1001  WRITE(3,110)
110   FORMAT(1X,'b1=')
      READ(1,102) b1
      WRITE(3,111)
111   FORMAT(1X,'b2=')
      READ(1,102) b2
1002  WRITE(3,112)
112   FORMAT(1X,'P=')
      READ(1,102) P
C
C initializari
C
      DO 10 k=1,3
        th(k)=0.
        th1(k)=0.
        u(k)=0
        v(k)=0
10    CONTINUE
      th2k1=0.
      vk2t=0.
```

```
C calcule simulare
C
      DO 11 k=3,85
        IF(Karma.EQ.2) GOTO 1003
C
C algoritm ARMA-1
C
        th1(k)=(th(k)-th(k-1))/Te
        v(k-1)=u(k-1)-d*(th1(k)-th1(k-1))/Te
        vk2t=Gama1*v(k-1)+Gama2*vk2t
        s(k)=C*(th(k)-w)+th1(k)
        semn=-1.
        IF(s(k).GE.0) semn=1.
        u(k)=d*(-C*th1(k)-P*semn)+up+Kpert*vk2t
        GOTO 1004
C
C algoritm ARMA-2
C
1003    th1(k)=(th(k)-th(k-1))/Te
        th2k=(th1(k)-th1(k-1))/Te
        th3k=(th2k-th2k1)/Te
        th2k1=th2k
        v(k-1)=u(k-1)-a3*th3k-a2*th2k-a1*th1(k)
        vk2t=Gama1*v(k-1)+Gama2*vk2t
        s(k)=th(k)-w+b1*th1(k)+b2*th2k
        semn=-1.
        IF(s(k).GT.0) semn=1.
        th1Dk=-b1*th2k-b2*th3k-P*semn
        th2Dk=(th1Dk-th1(k))/Te
        th3Dk=(th2Dk-th2k)/Te
        u(k)=a3*th3Dk+a2*th2Dk+a1*th1Dk+up+Kpert*vk2t
C
C limitare !u(k)!
C
1004    IF(u(k).GT.40000.0) u(k)=40000.0
        IF(u(k).LT.-40000.0) u(k)=-40000.0
        IF(Kpce.EQ.2) GOTO 1005
C
C model PCE-1
C
        th(k+1)=2*th(k)-th(k-1)+Alfa*(u(k)+2*u(k-1)+u(k-2))
        GOTO 1006
C
C model PCE-2
C
1005    th(k+1)=Beta1*th(k)+Beta2*th(k-1)+Beta3*th(k-2)
        th(k+1)=th(k+1)+Beta4*(u(k)+3*u(k-1)+3*u(k-2)+u(k-3))
1006    CONTINUE
11    CONTINUE
      CALL grafic(th,'THETA')
      CALL grafic(th1,'OMEGA')
      CALL grafic(s,'S     ')
      CALL grafic(u,'U     ')
      CALL grafic(v,'PERT.')
      END
```

```
      SUBROUTINE grafic(vect,mes)
      BYTE line(100),mes(5)
      INTEGER tras
      REAL vect(85),ymin,ymax,deltay
C
      WRITE(3,114) mes
114   FORMAT(2X,5A1,1X,'TRASARE (0/1):')
      READ(1,115) tras
115   FORMAT(I2)
      IF(tras.NE.1) GOTO 1007
C
      WRITE(2,116) mes
116   FORMAT(2X,5A1,/)
      ymin=vect(1)
      ymax=vect(1)
      DO 12 i=3,85
        IF (vect(i).LT.ymin) ymin=vect(i)
        IF (vect(i).GT.ymax) ymax=vect(i)
12    CONTINUE
      WRITE(2,117) ymin,ymax
117   FORMAT (12X,'MIN=',G14.6,32X,'MAX=',G14.6,/)
      deltay=(ymax-ymin)/99.
      DO 14 i=3,85
        DO 13 j=1,100
          line(j)=' '
          IF((i.EQ.3).OR.(i.EQ.85)) line(j)='-'
          IF((j.EQ.1).OR.(j.EQ.100)) line(j)='I'
          IF((( ymin).GE.((j-1)*deltay)).AND.((ymin).LT.(j*deltay)))
     *    line(j)='I'
          IF(((vect(i)-ymin).GE.((j-1)*deltay))
     *    .AND.((vect(i)-ymin).LT.(j*deltay)))
     *    line(j)='*'
13      CONTINUE
        WRITE(2,118) vect(i),line
118     FORMAT (1X,G10.3,1X,100A1)
14    CONTINUE
1007  RETURN
      END
```

```
      PROGRAM simulare
      DIMENSION th(850),th1(850),s(850),u(850),v(850)
      REAL k1
C
C preluare Te
C
      WRITE(3,101)
101   FORMAT(1X,'Te=')
      READ(1,102) Te
102   FORMAT(F15.7)
C
C parametri PCE
C
      Ts=325.52E-9
      Ta=1.3E-3
      Tm=47.0E-3
      A=0.457
      d=0.1028
C
C coeficienti simulare PCE
C
      Alfa=Te**2/4./d
      div=8*Ta*Tm+4*Te*Tm+2*Te*Te
      Beta1=(24*Ta*Tm+4*Te*Tm-2*Te*Te)/div
      Beta2=( 24*Ta*Tm+4*Te*Tm+2*Te*Te)/div
      Beta3=(8*Ta*Tm-4*Te*Tm+2*Te*Te)/div
      Beta4=(A*Te**3)/div
C
C coeficienti ARMA
C
      a1=1/A
      a2=Tm/A
      a3=Tm*Ta/A
C
C coeficienti estimator perturbatie
C
      k1=0.6
      Gama1=1/(1+k1)
      Gama2=k1*Gama1
C
C preluare treapta referinta
C
      WRITE(3,103)
103   FORMAT(1X,'w=')
      READ(1,102) w
C
C preluare perturbatie
C
      WRITE(3,104)
104   FORMAT(1X,'up=')
      READ(1,102) up
```

```
C
C introducere estimator perturbatii
C
      WRITE(3,105)
105   FORMAT(1X,'INTRODUCEREA ESTIMATORULUI DE PERTURBATII (0/1):')
      READ (3,106) Kpert
106   FORMAT(I2)
      WRITE(3,107)
C
C preluare tip PCE
C
107   FORMAT(1X,'TIP PCE (1/2):')
      READ(3,106) Kpce
C
C preluare tip ARMA
C
      WRITE(3,108)
108   FORMAT(1X,'TIP ARMA (1/2):')
      READ(3,106) Karma
      IF(Karma.EQ.2) GOTO 1001
C
C preluare coeficienti ARMA
C
      WRITE(3,109)
109   FORMAT(1X,'C=')
      READ(1,102) C
      GOTO 1002
1001  WRITE(3,110)
110   FORMAT(1X,'b1=')
      READ(1,102) b1
      WRITE(3,111)
111   FORMAT(1X,'b2=')
      READ(1,102) b2
1002  WRITE(3,112)
112   FORMAT(1X,'P=')
      READ(1,102) P
C
C initializari
C
      DO 10 k=1,3
        th(k)=0.
        th (k)=0.
        u(k)=0
        v(k)=0
10    CONTINUE
      th2k1=0.
      vk2t=0.
```

```
C calcule simulare
C
      DO 11 k=3,850
        IF(Karma.EQ.2) GOTO 1003
C
C algoritm ARMA-1
C
        th1(k)=(th(k)-th(k-1))/Te
        v(k-1)=u(k-1)-d*(th1(k)-th1(k-1))/Te
        vk2t=Gama1*v(k-1)+Gama2*vk2t
        s(k)=C*(th(k)-w)+th1(k)
        semn=-1.
        IF(s(k).GE.0) semn=1.
        u(k)=d*(-C*th1(k)-P*semn)+up+Kpert*vk2t
        GOTO 1004
C
C algoritm ARMA-2
C
1003    th1(k)=(th(k)-th(k-1))/Te
        th2k=(th1(k)-th1(k-1))/Te
        th3k=(th2k-th2k1)/Te
        th2k1=th2k
        v(k-1)=u(k-1)-a3*th3k-a2*th2k-a1*th1(k)
        vk2t=Gama1*v(k-1)+Gama2*vk2t
        s(k)=th(k)-w+b1*th1(k)+b2*th2k
        semn=-1.
        IF(s(k).GT.0) semn=1.
        th1Dk=-b1*th2k-b2*th3k-P*semn
        th2Dk=(th1Dk-th1(k))/Te
        th3Dk=(th2Dk-th2k)/Te
        u(k)=a3*th3Dk+a2*th2Dk+a1*th1Dk+up+Kpert*vk2t
C
C limitare !u(k)!
C
1004    IF(u(k).GT.40000.0) u(k)=40000.0
        IF(u(k).LT.-40000.0) u(k)=-40000.0
        IF(Kpce.EQ.2) GOTO 1005
C
C model PCE-1
C
        th(k+1)=2*th(k)-th(k-1)+Alfa*(u(k)+2*u(k-1)+u(k-2))
        GOTO 1006
C
C model PCE-2
C
1005    th(k+1)=Beta1*th(k)+Beta2*th(k-1)+Beta3*th(k-2)
        th(k+1)=th(k+1)+Beta4*(u(k)+3*u(k-1)+3*u(k-2)+u(k-3))
1006    CONTINUE
11    CONTINUE
      CALL grafic(th,'THETA')
      CALL grafic(th1,'OMEGA')
      CALL grafic(s,'S    ')
      CALL grafic(u,'U    ')
      CALL grafic(v,'PERT.')
      END
```

```
      SUBROUTINE grafic(vect,mes)
      BYTE line(100),mes(5)
      INTEGER tras
      REAL vect(850),ymin,ymax,deltay
C
      WRITE(3,114) mes
114   FORMAT(2X,5A1,1X,'TRASARE (0/1):')
      READ(1,115) tras
115   FORMAT(I2)
      IF(tras.NE.1) GOTO 1007
C
      WRITE(2,116) mes
116   FORMAT(2X,5A1,/)
      ymin=vect(1)
      ymax=vect(1)
      DO 12 i=3,850
        IF (vect(i).LT.ymin) ymin=vect(i)
        IF (vect(i).GT.ymax) ymax=vect(i)
12    CONTINUE
      WRITE(2,117) ymin,ymax
117   FORMAT (12X,'MIN=',G14.6,32X,'MAX=',G14.6,/)
      deltay=(ymax-ymin)/99.
      DO 14 i=1,82
        DO 13 j=1,100
          line(j)=' '
          IF((i.EQ.1).OR.(i.EQ.82)) line(j)='-'
          IF((j.EQ.1).OR.(j.EQ.100)) line(j)='I'
          IF(((-ymin).GE.((j-1)*deltay)).AND.((-ymin).LT.(j*deltay)))
     *    line(j)='I'
          IF(((vect(10*i-7)-ymin).GE.((j-1)*deltay))
     *    .AND.((vect(10*i-7)-ymin).LT.(j*deltay)))
     *    line(j)='*'
13      CONTINUE
        WRITE(2,118) vect(10*i-7),line
118     FORMAT (1X,G10.3,1X,100A1)
14    CONTINUE
1007  RETURN
      END
```

ANEXA A6

REZULTATE EXPERIMENTALE OBTINUTE PRIN SIMULARE PENTRU METODA DE REGLARE NUMERICA MODAL-ALUNECATOARE APLICATA LA UN SISTEM DE ACTIONARE CU MOTOR DE CURENT CONTINUU

Rezultatele programului de SIMULARE

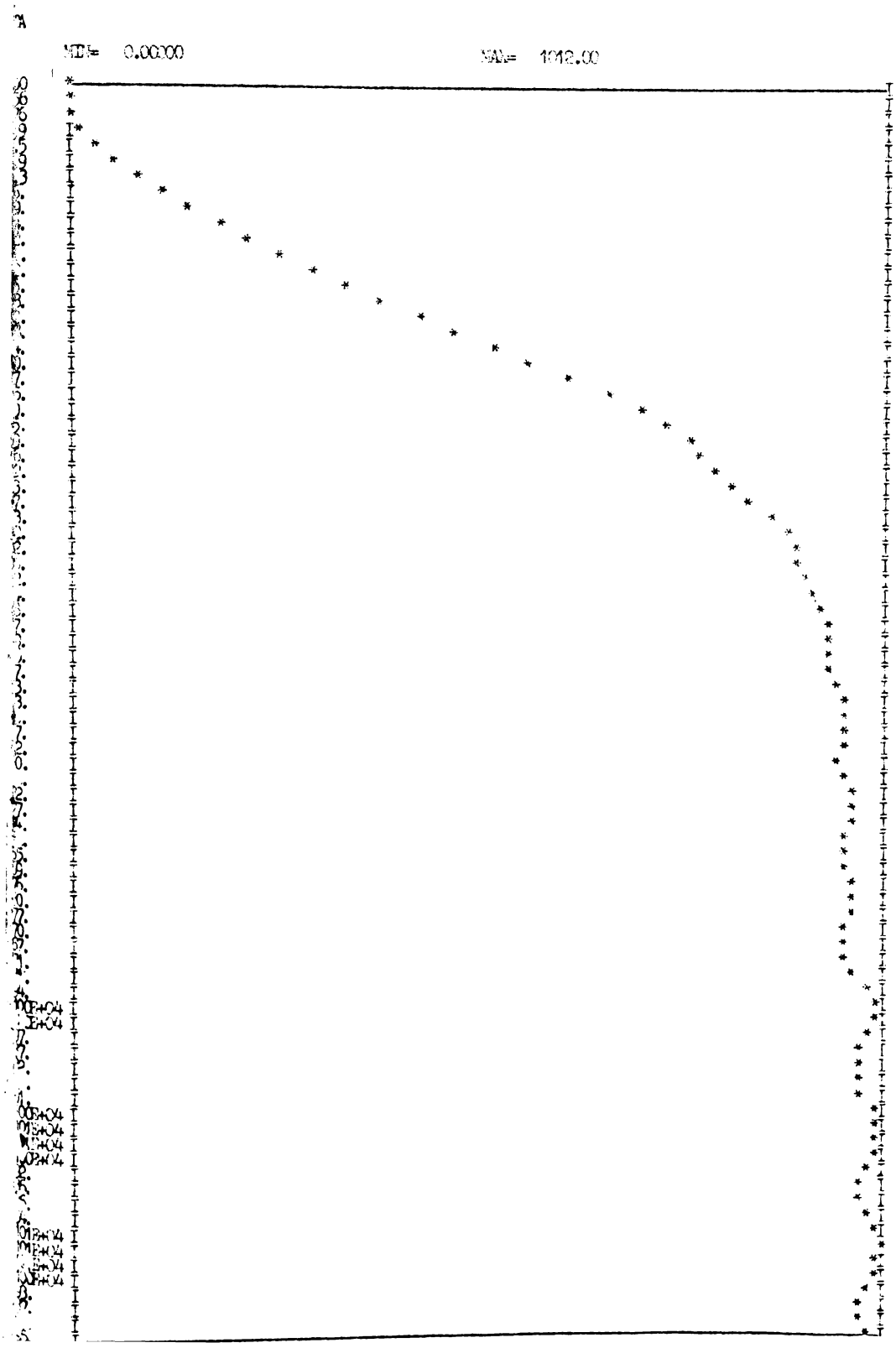
-algoritm de reglare : tip ARMA - 1
fara compensarea perturbatiilor
fara limitarea modulului comenzii
Q = 10
P = 40000

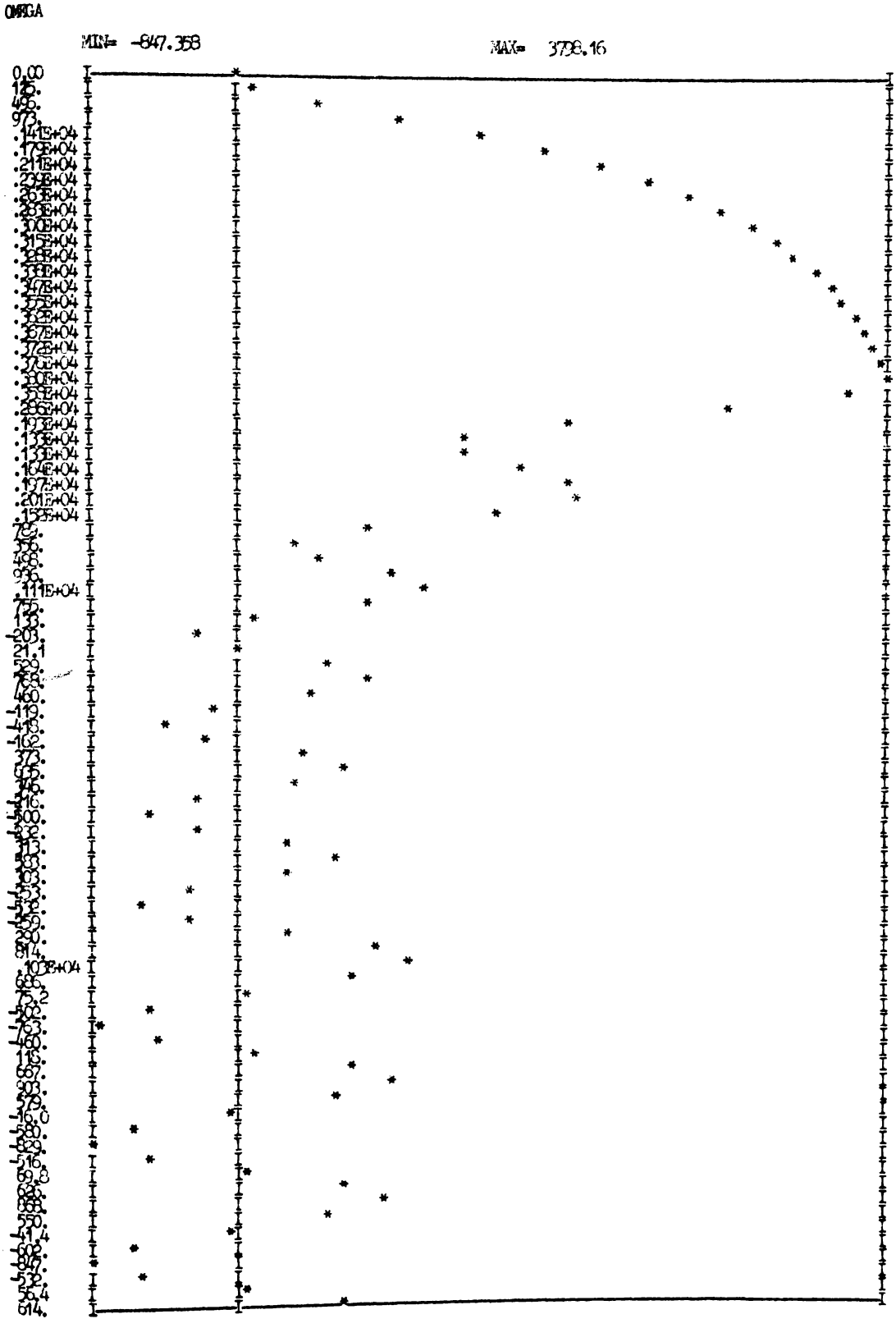
-modelul procesului condus extins : PCE - 1

-perioada de esantionare : Te = 12.5 msec

-referinta de pozitie : treapta cu amplitudinea w = 1000

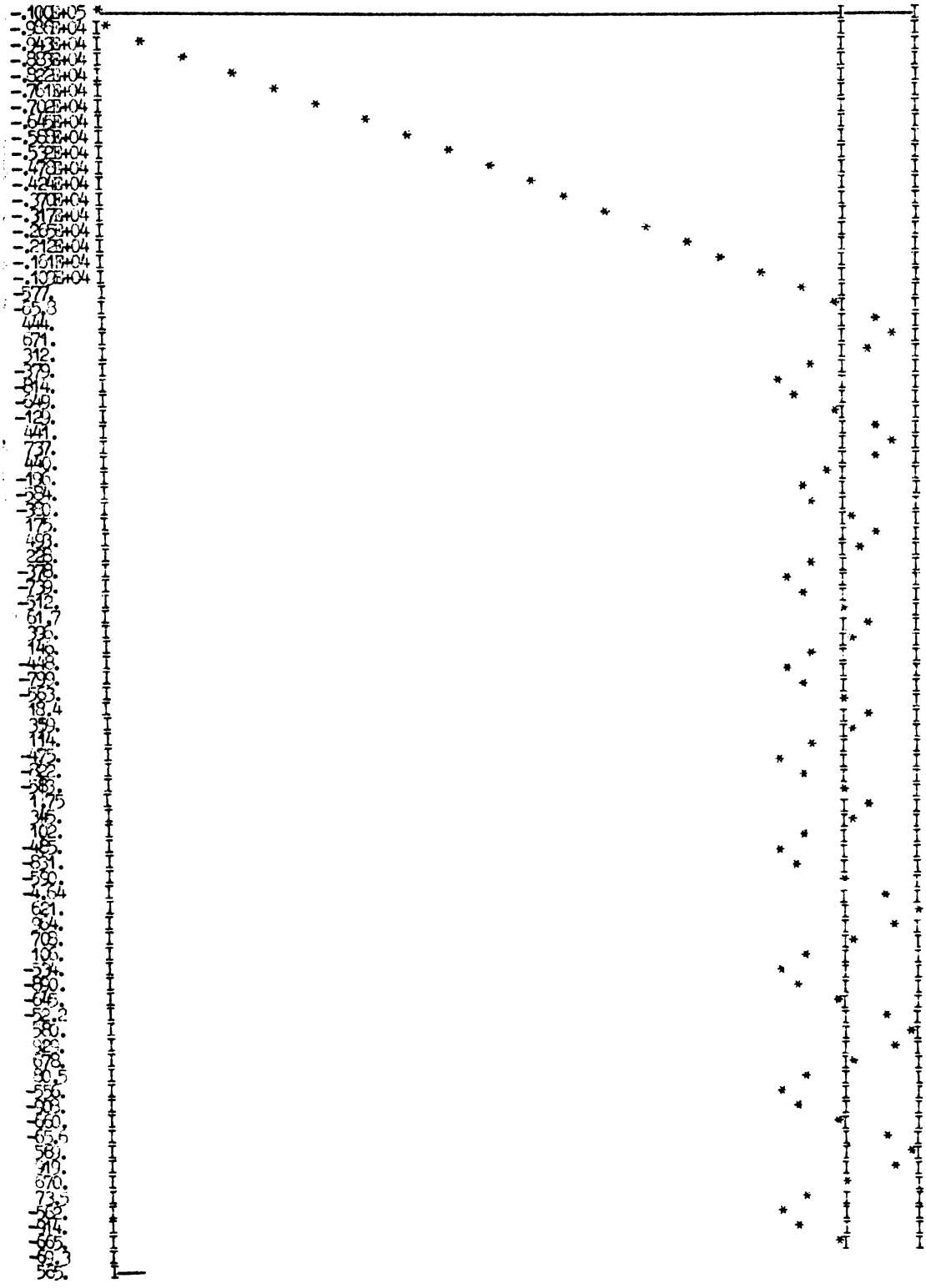
-perturbatia simulata : up = 0





S

MIN= -10000.00 MAX= 963.940



Rezultatele programului de SIMULARE

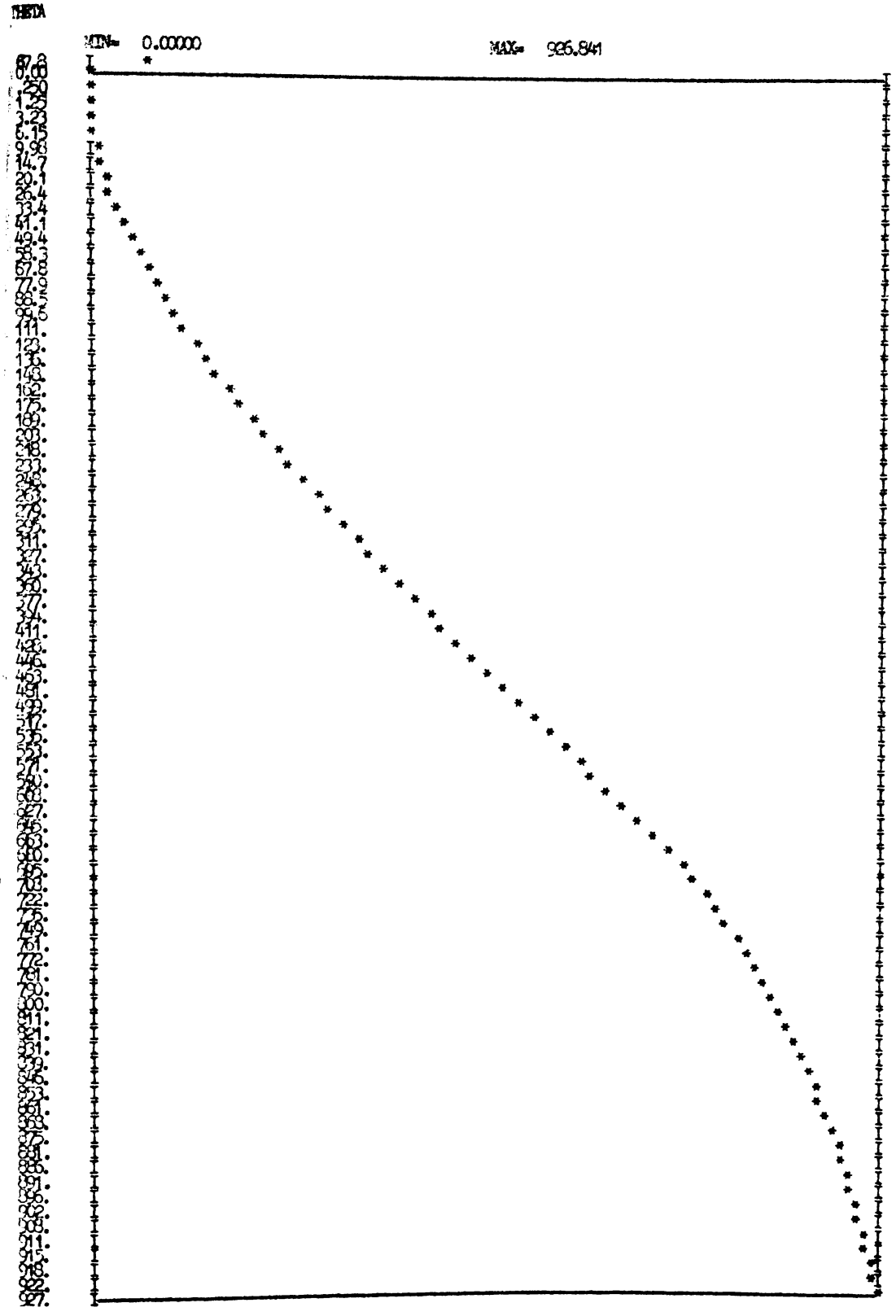
-algoritm de reglare : tip ARMA - 1
fara compensarea perturbatiilor
fara limitarea modulului comenzii
$\hat{S}$ = 10
P = 40000

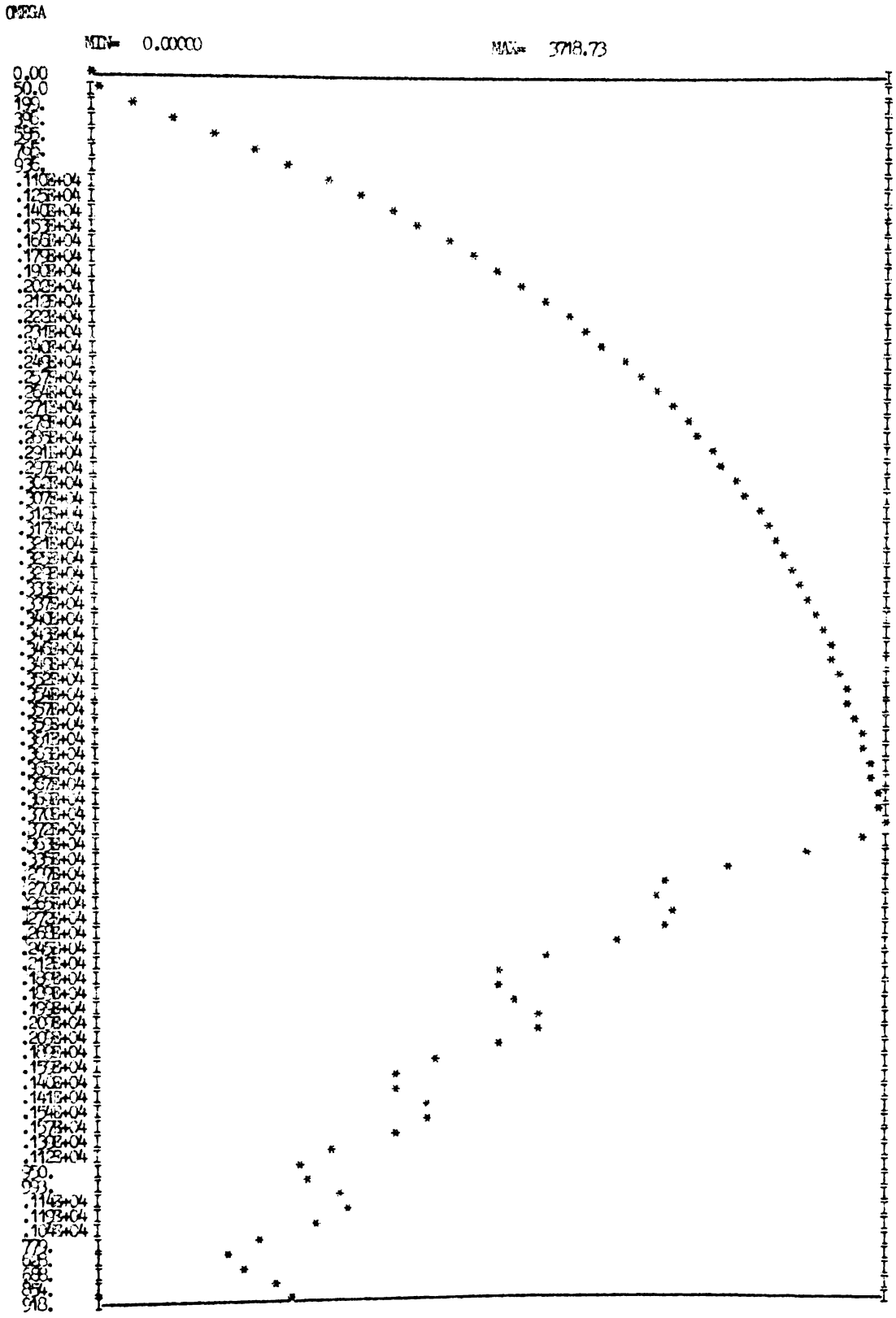
-modelul procesului condus extins : PCE - 1

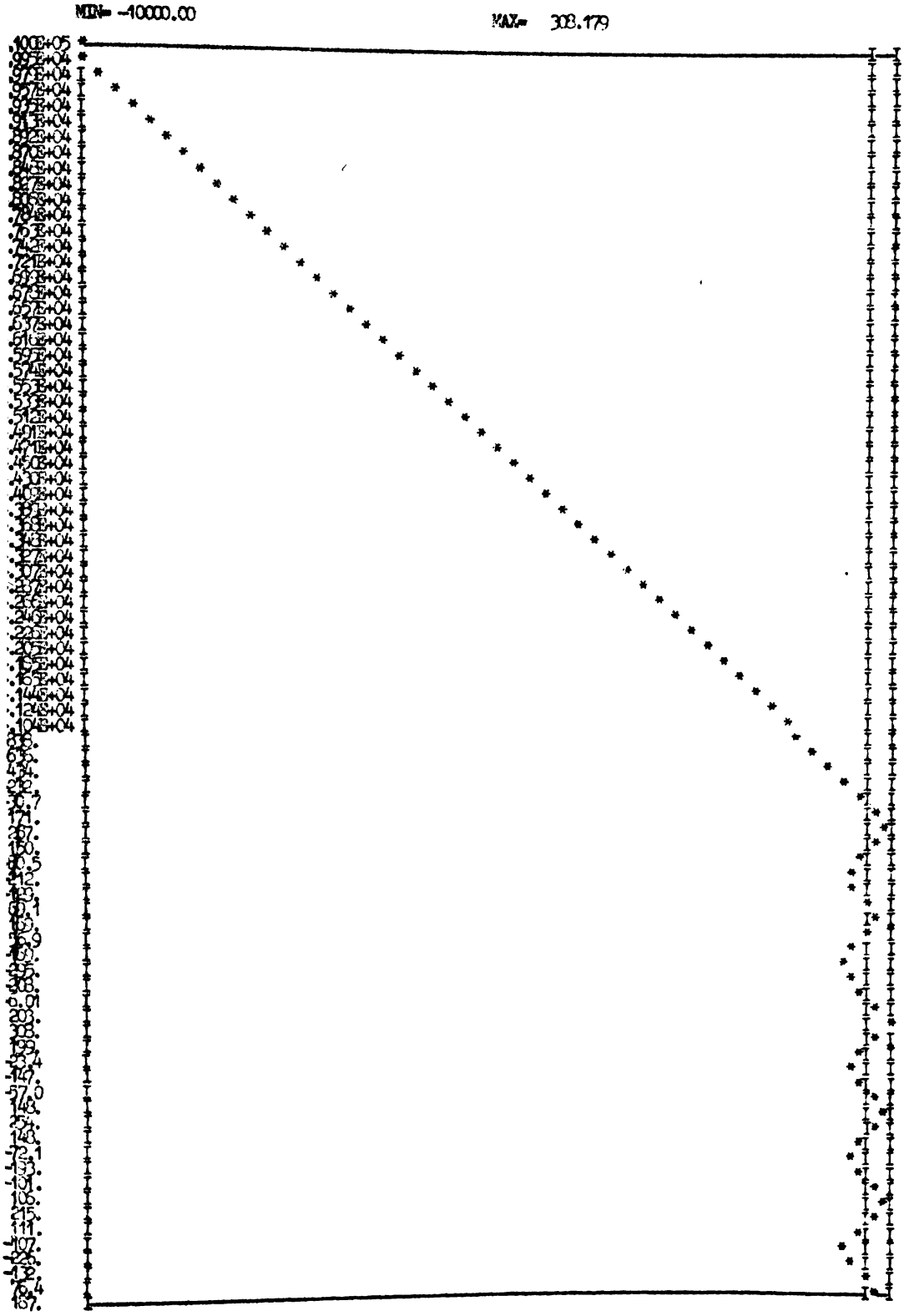
-perioada de esantionare : Te = 5 msec

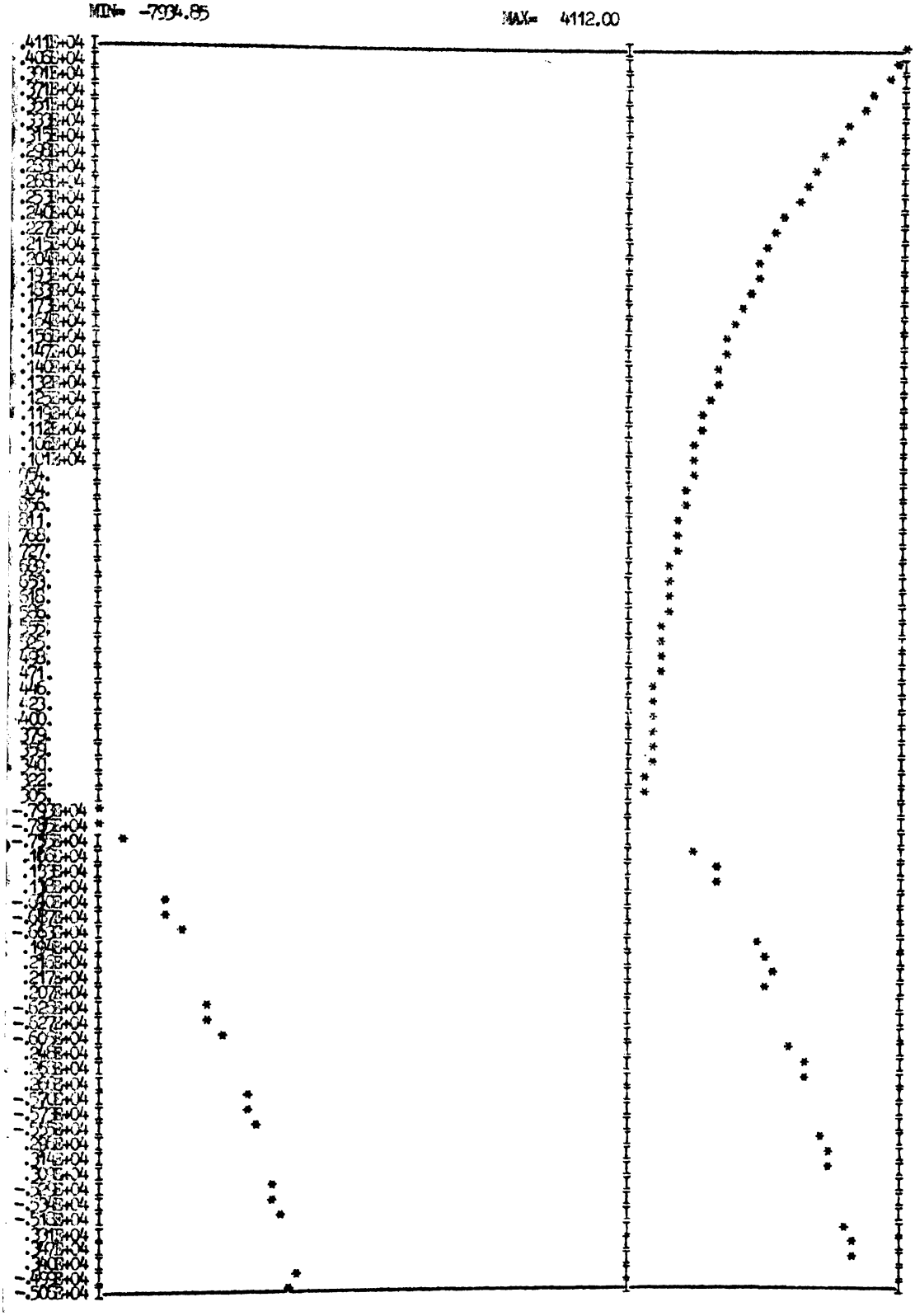
-referinta de pozitie : treapta cu amplitudinea w = 1000

-perturbatia simulata : up = 0









Rezultatele programului de SIMULARE

-algoritm de reglare : tip ARMA - 1
fara compensarea perturbatiilor
fara limitarea modulului comenzii
C = conform tabelului
P = conform tabelului

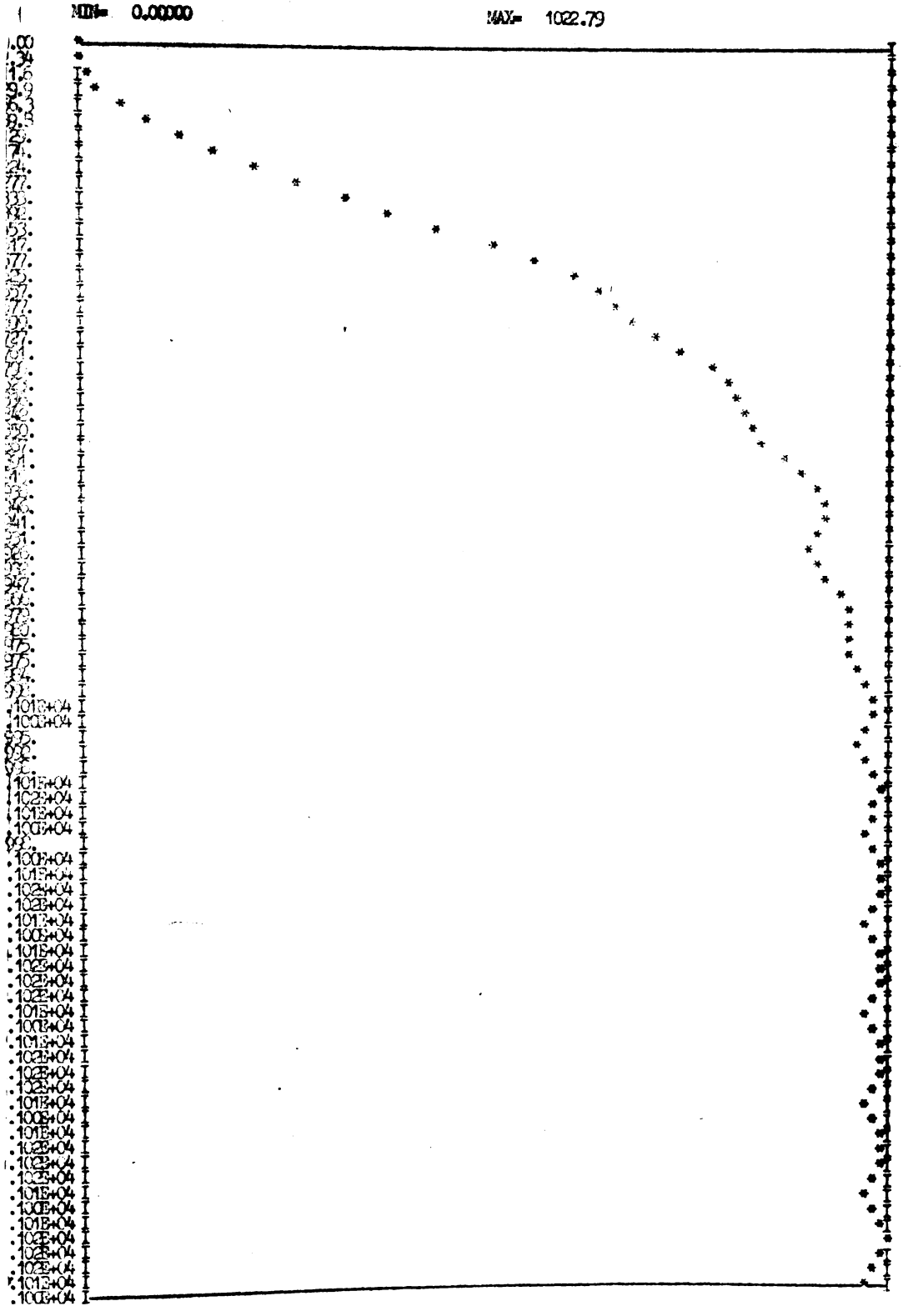
-modelul procesului condus extins : PCE - 1

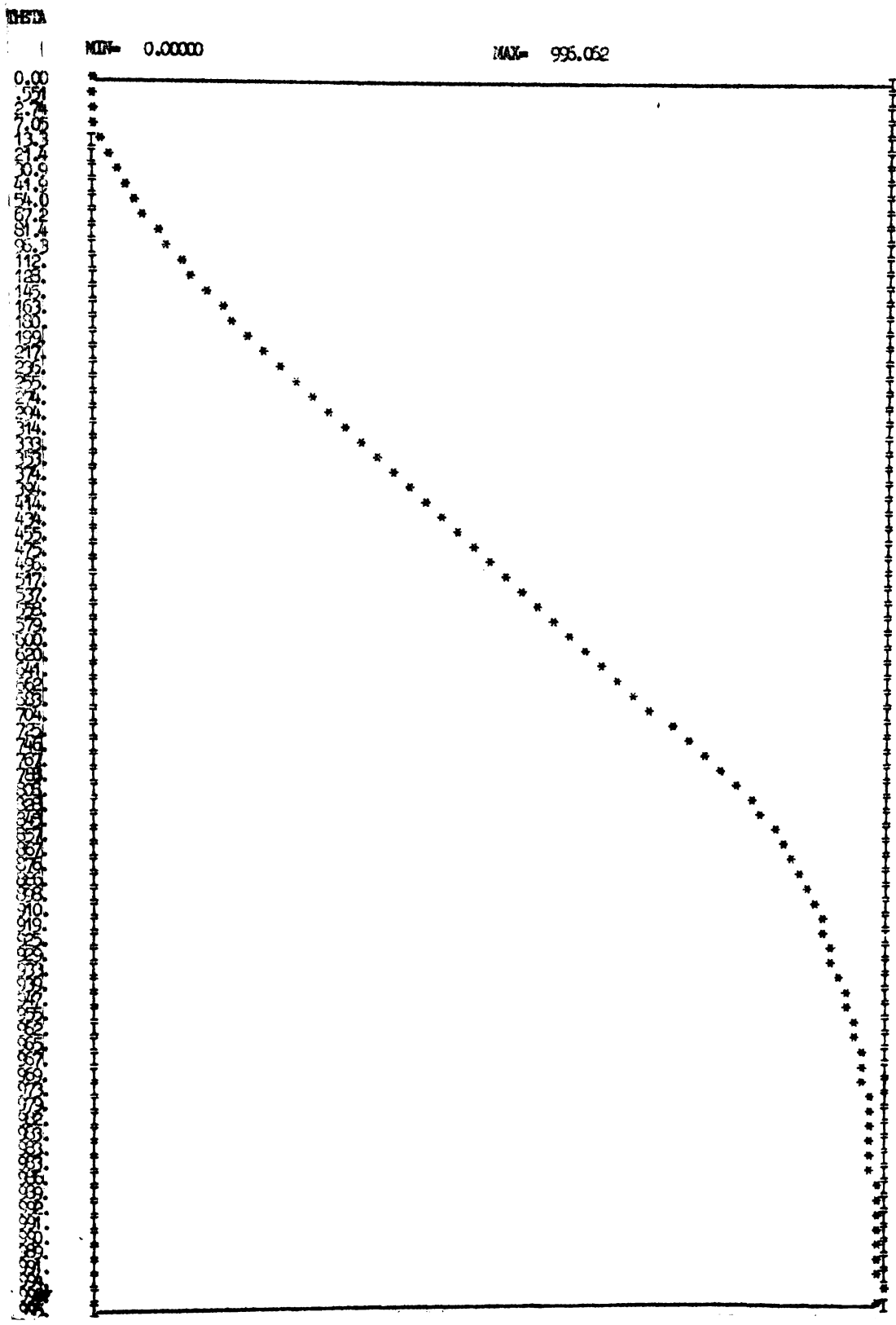
-perioada de esantionare : Te = 12.5 msec

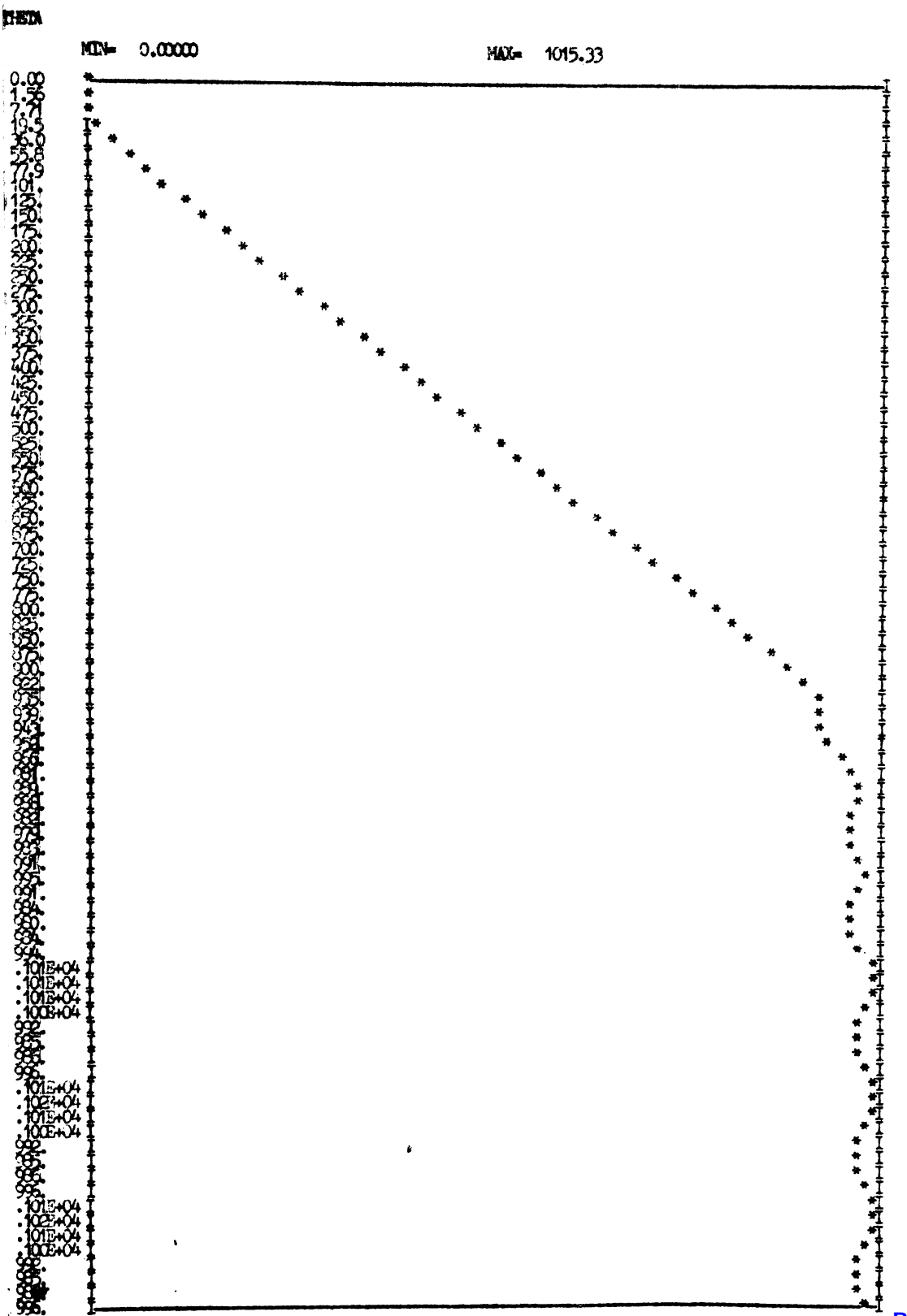
-referinta de pozitie : treapta cu amplitudinea w = 1000

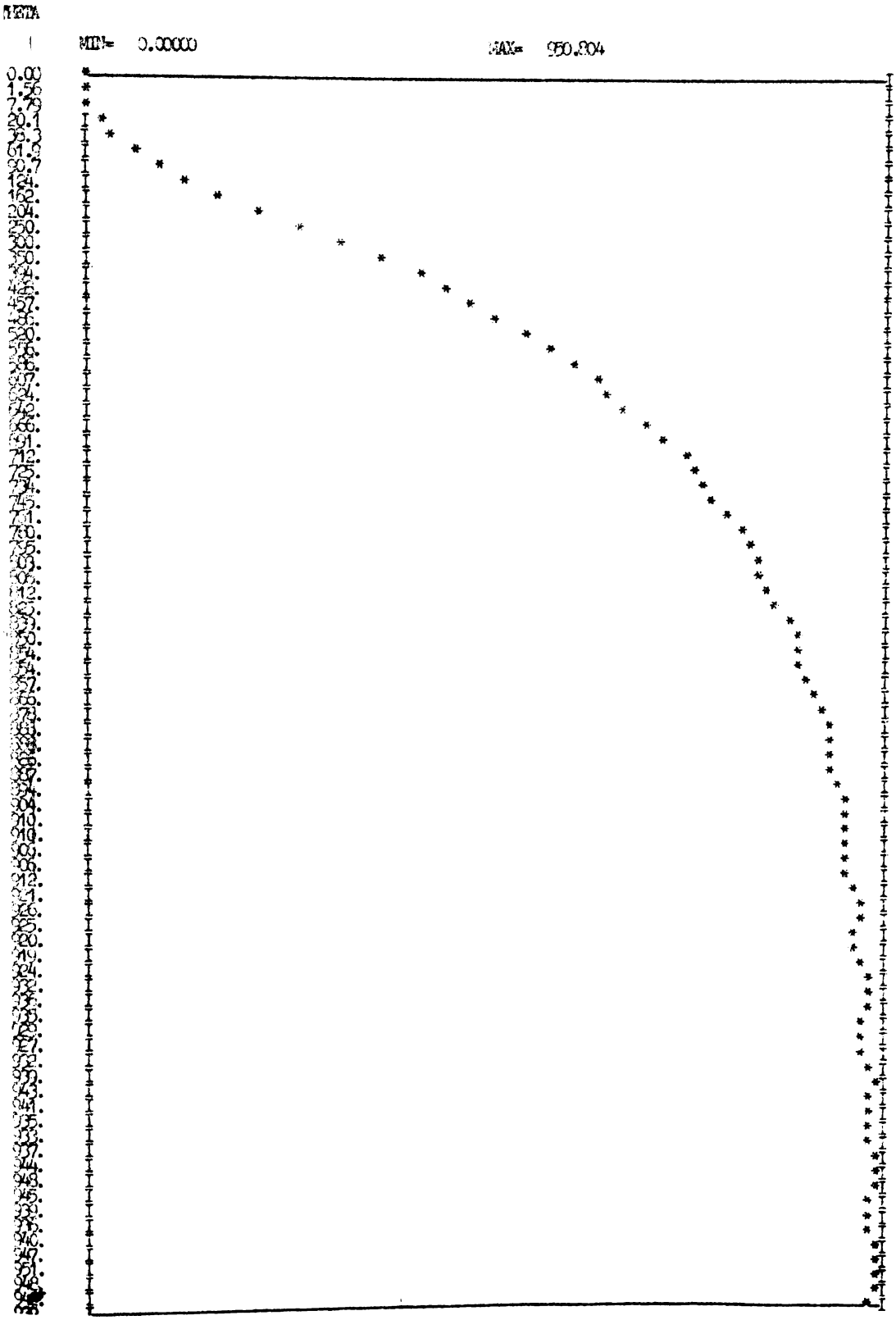
-perturbatia simulata : up = 0

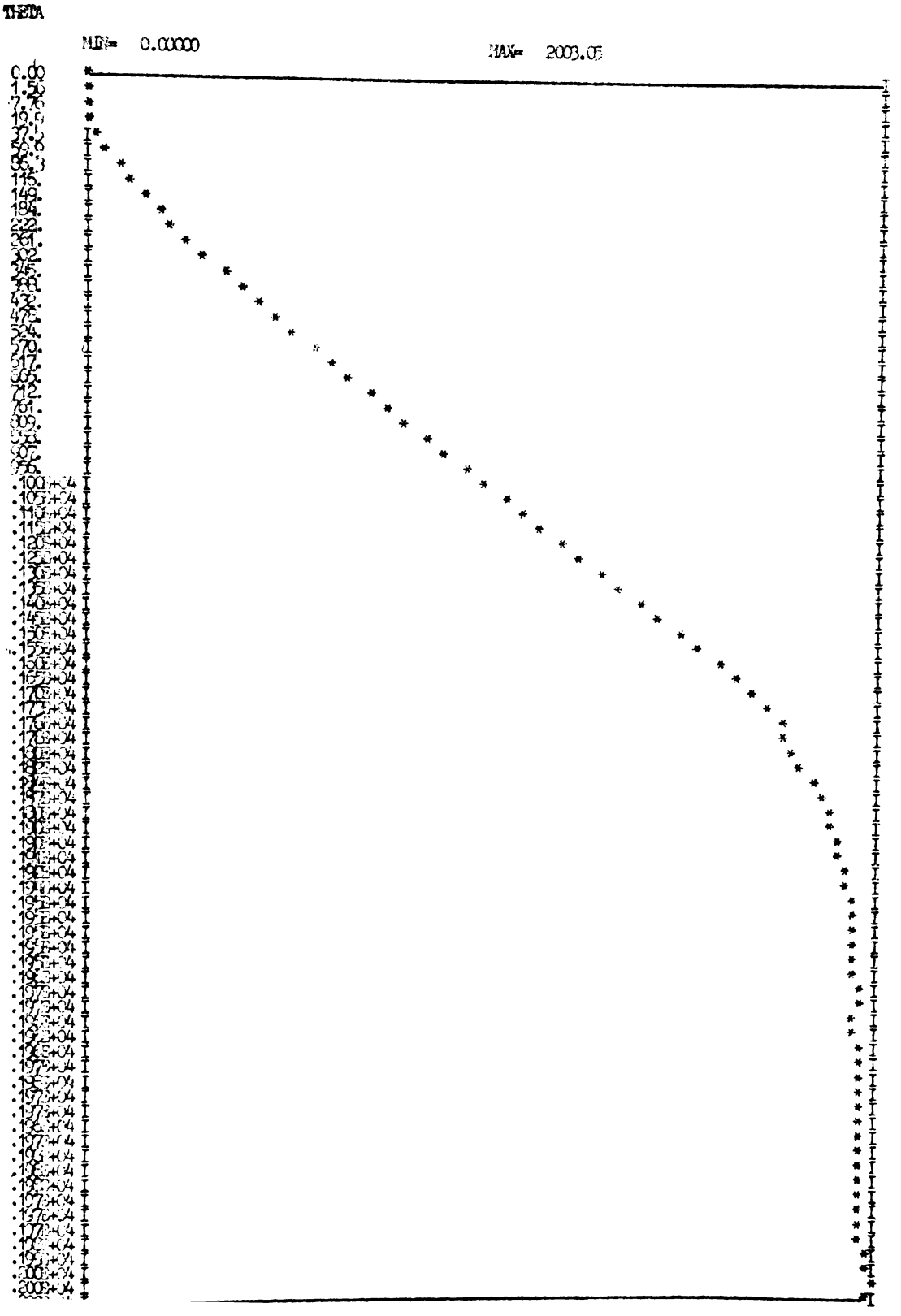
grafic nr.	C	P	w
1	10	60000	1000
2	10	20000	1000
3	20	40000	1000
4	5	40000	1000
5	10	40000	2000
6	10	40000	500

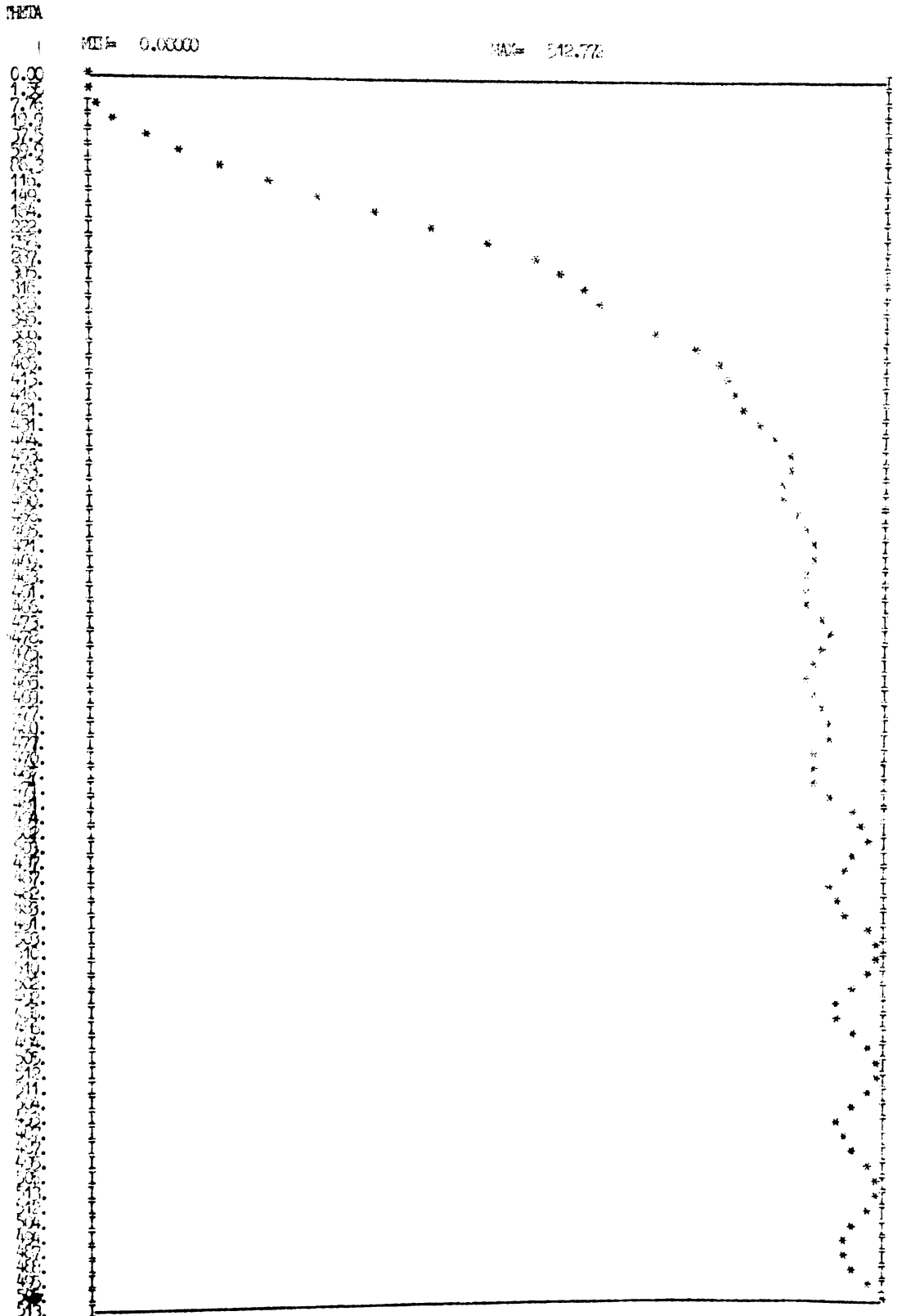












Rezultatele programului de SIMULARE

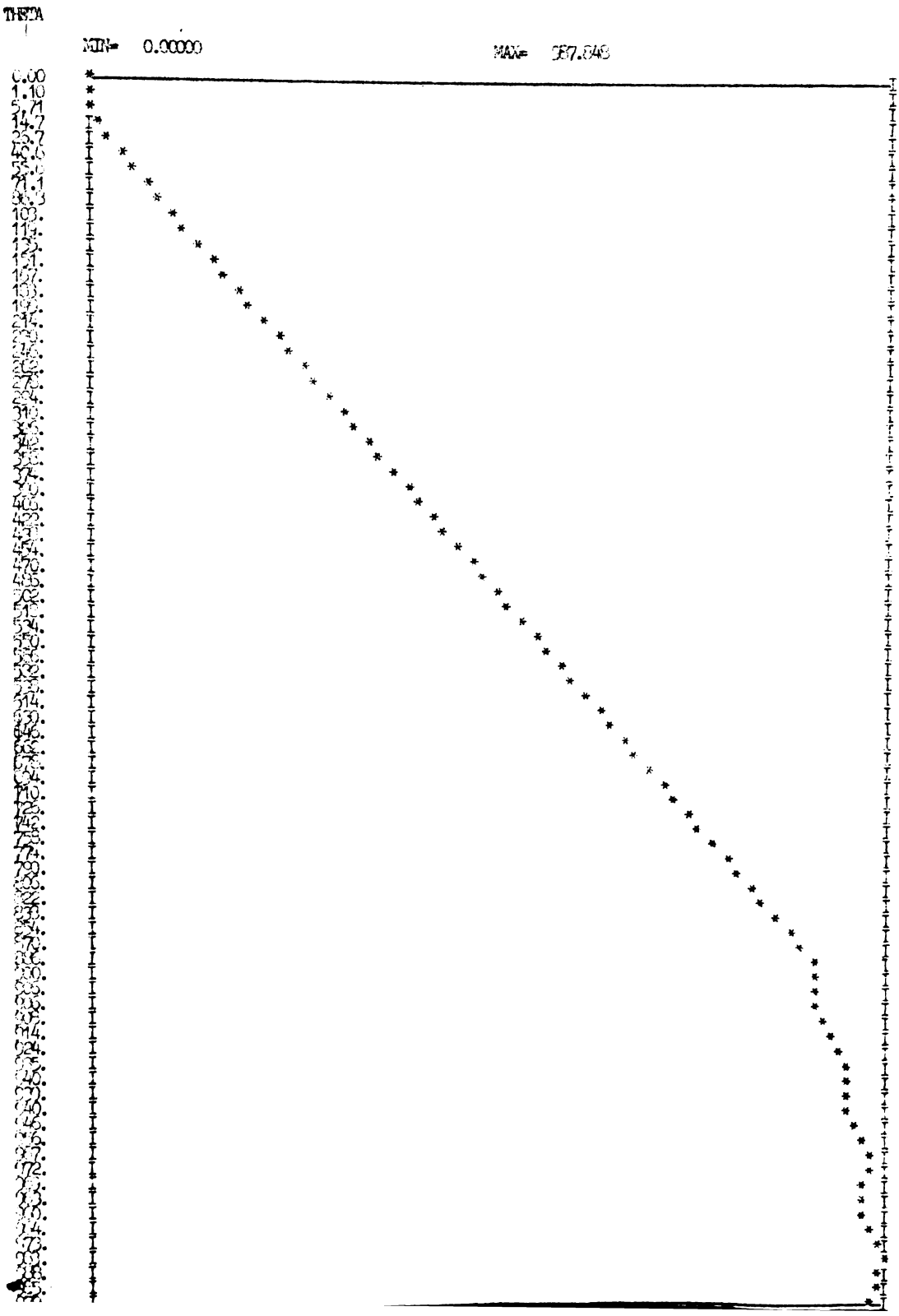
-algoritm de reglare : tip ARMA - 1
fara compensarea perturbatiilor
fara limitarea modulului comenzii
ζ = 10
ρ = 40000

-modelul procesului condus extins : PCE - 2

-perioada de esantionare : Te = 12.5 msec

-referinta de pozitie : treapta cu amplitudinea w = 1000

-perturbatia simulata : up = 0



Rezultatele programului de SIMULARE

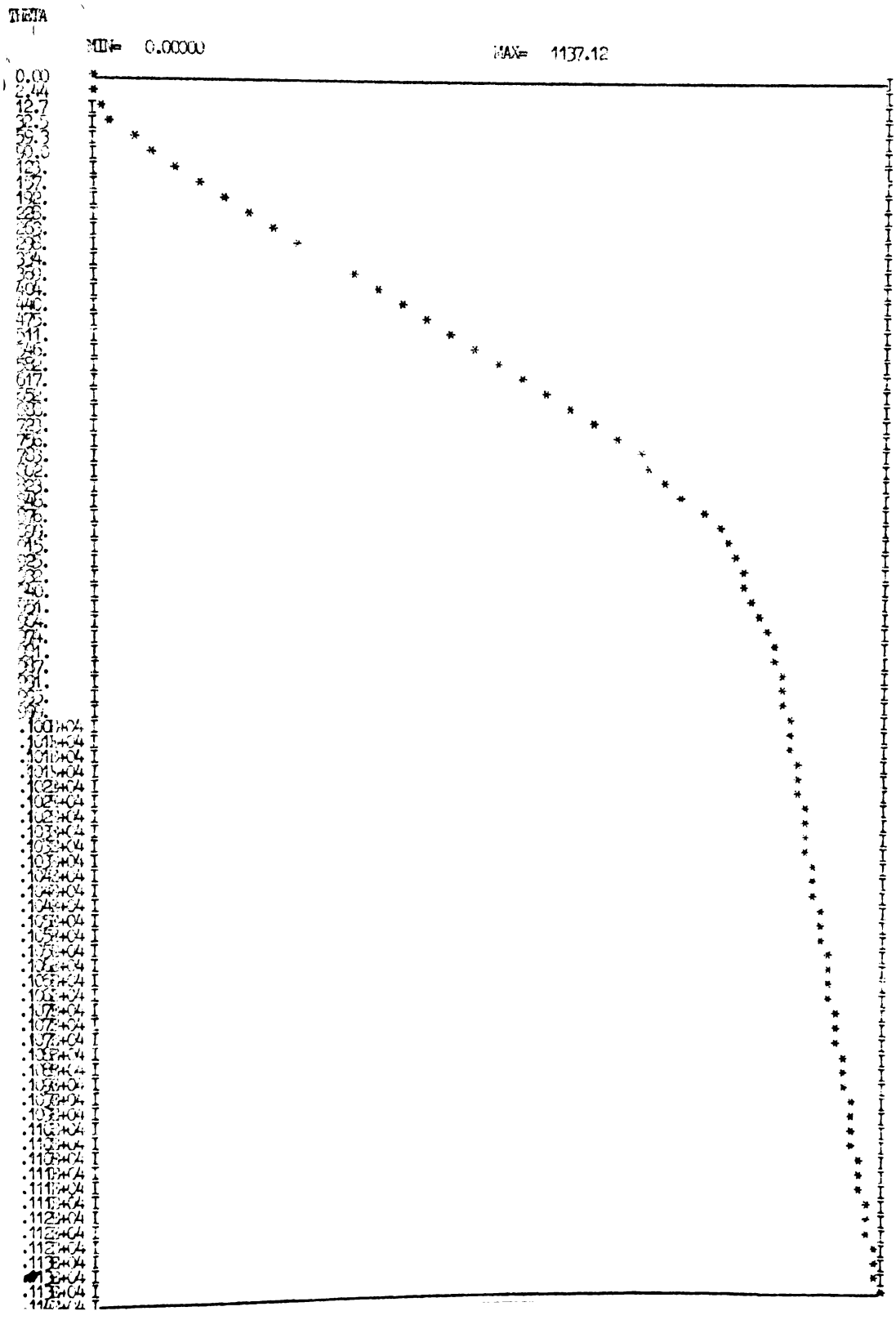
-algoritm de reglare : tip ARMA - 1
fara compensarea perturbatiilor
fara limitarea modulului comenzii
ρ = 10
γ = 40000

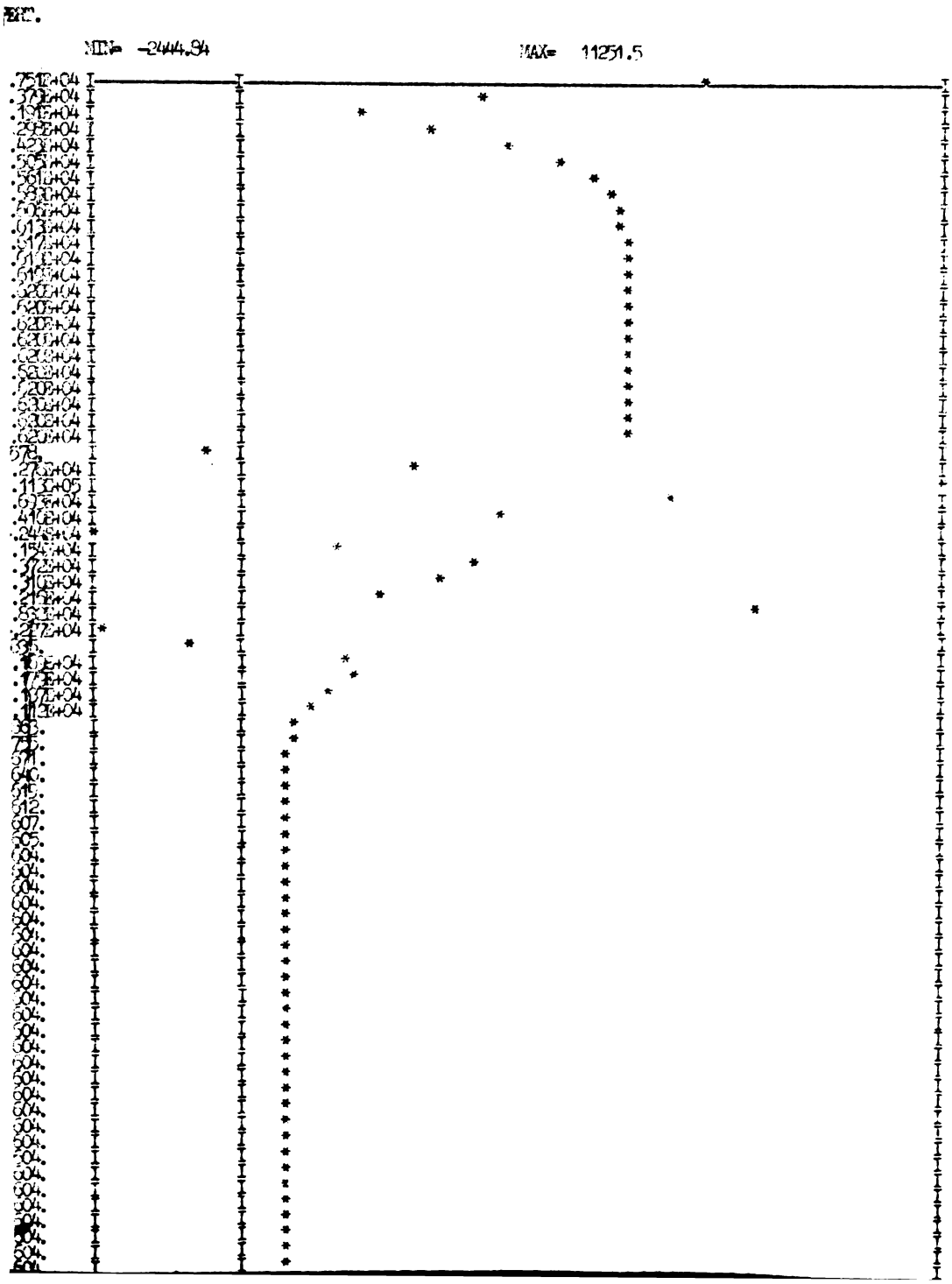
-modelul procesului condus extins : PCE - 2

-perioada de esantionare : Te = 12,5 msec

-referinta de pozitie : treapta cu amplitudinea w = 1000

-perturbatia simulata : up = 5000





Rezultatele programului de SIMULARE

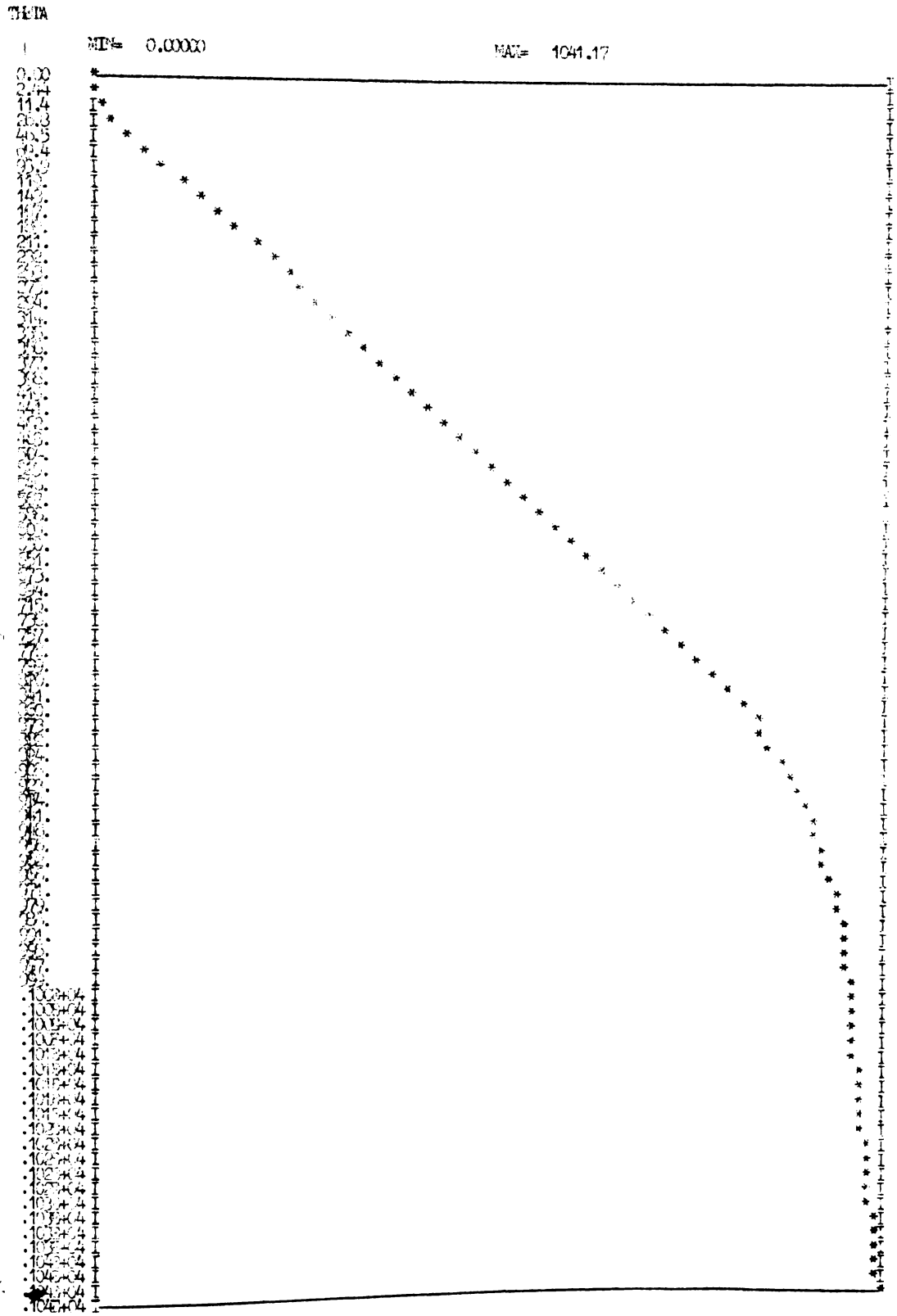
-algoritm de reglare : tip ARMA - 1
cu compensarea perturbatiilor
fara limitarea modulului comenzii
Q = 10
P = 40000

-modelul procesului condus extins : PCE - 2

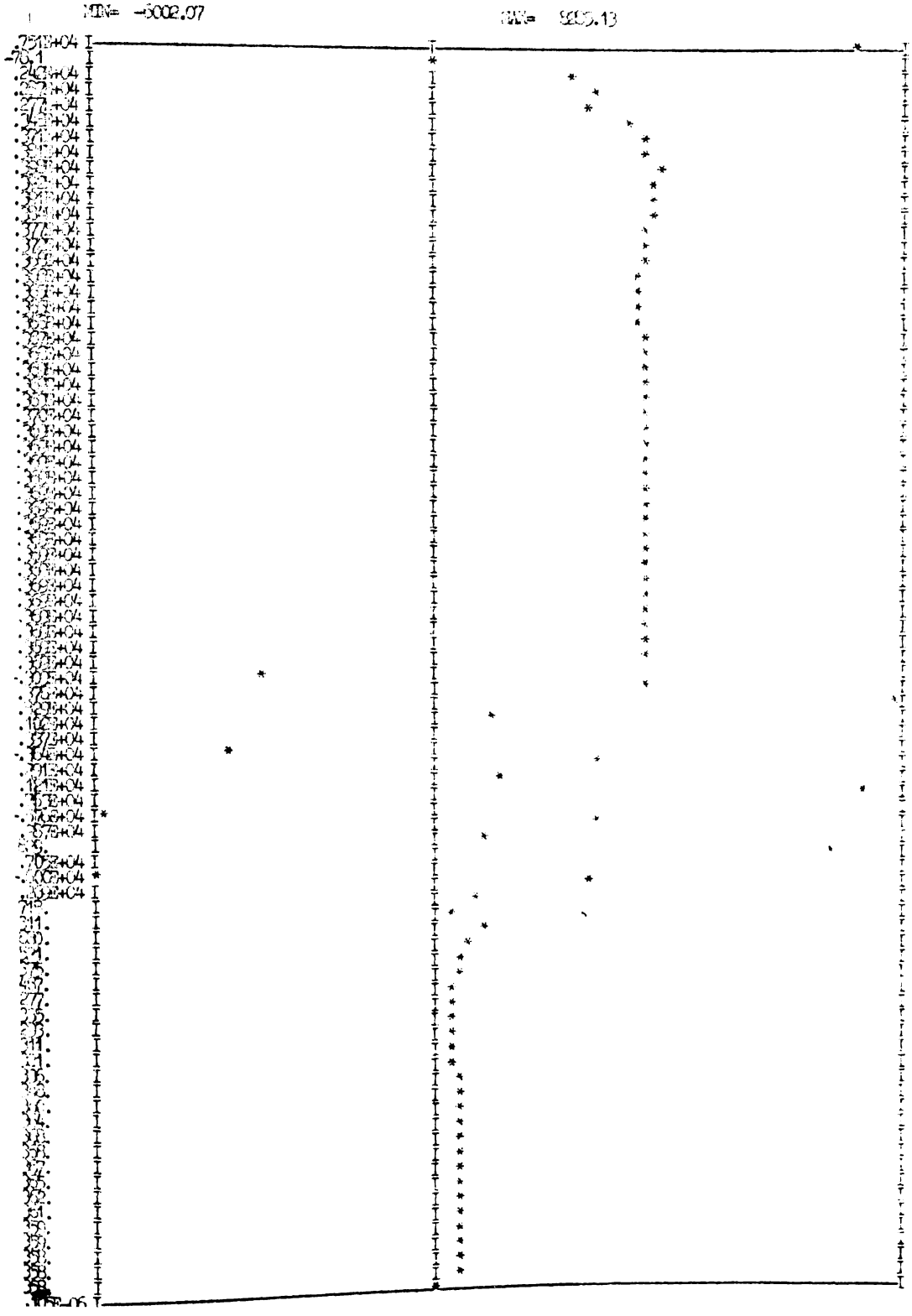
-perioada de esantionare : Te = 12.5 msec

-referinta de pozitie : treapta cu amplitudinea w = 1000

-perturbatia simulata : up = 5000



PSPT.



Rezultatele programului de SIMULARE

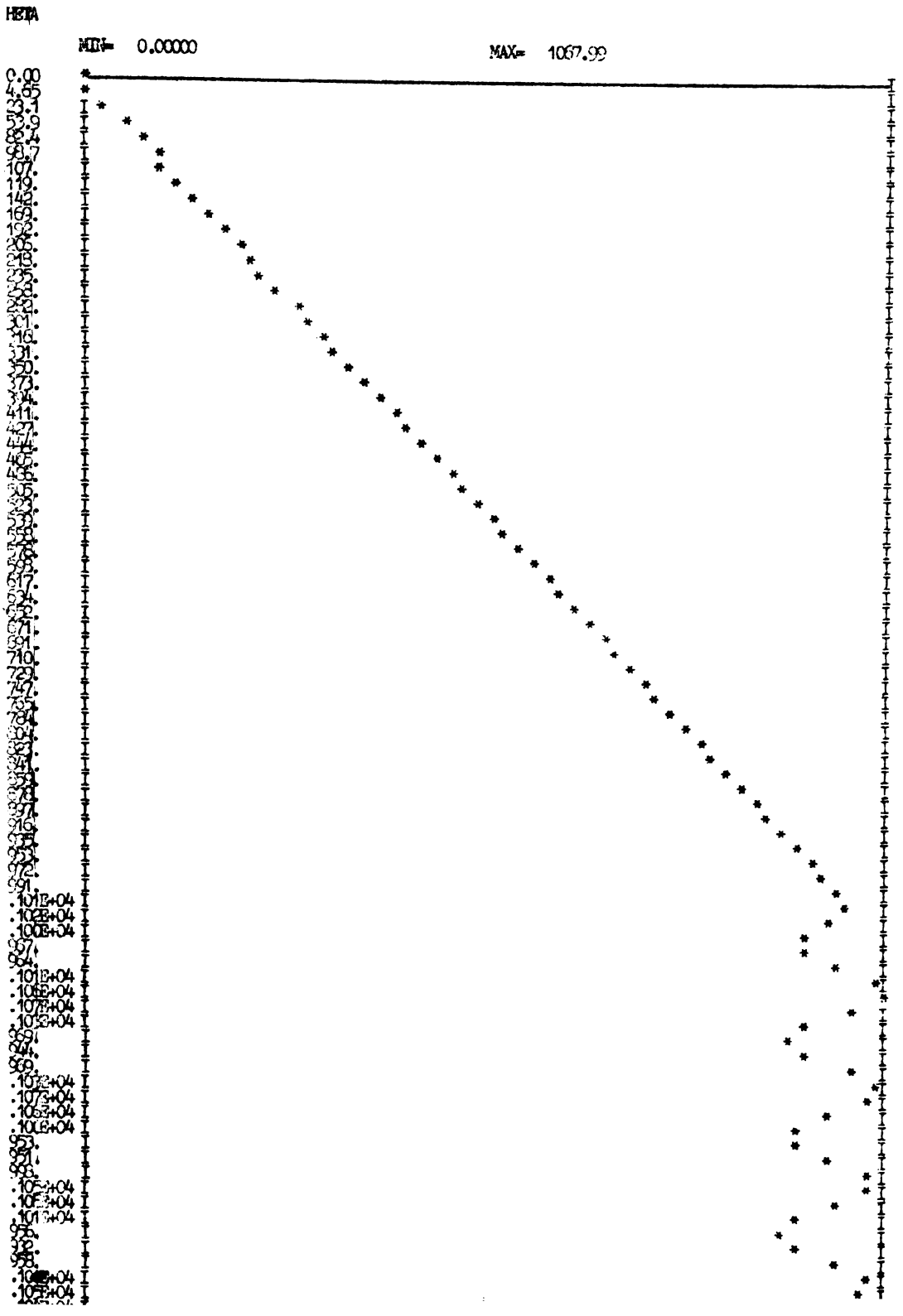
-algoritm de reglare : tip ARMA - 2
fara compensarea perturbatiilor
fara limitarea modulului comenzii
b1 = 7.81E-4
b2 = 6.10E-7
P = 1500

-modelul procesului condus extins : PCE - 2

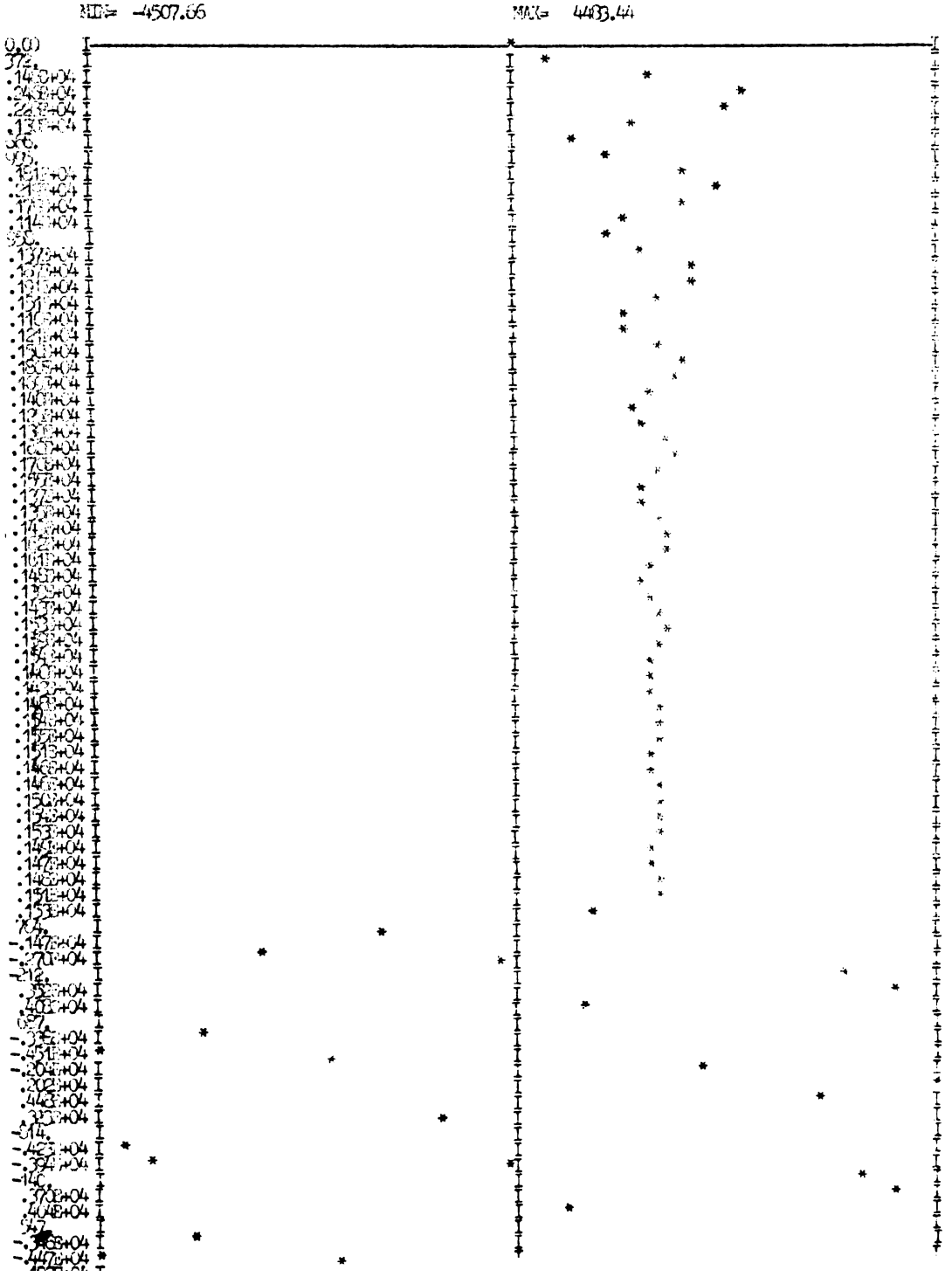
-perioada de esantionare : Te = 12.5 msec

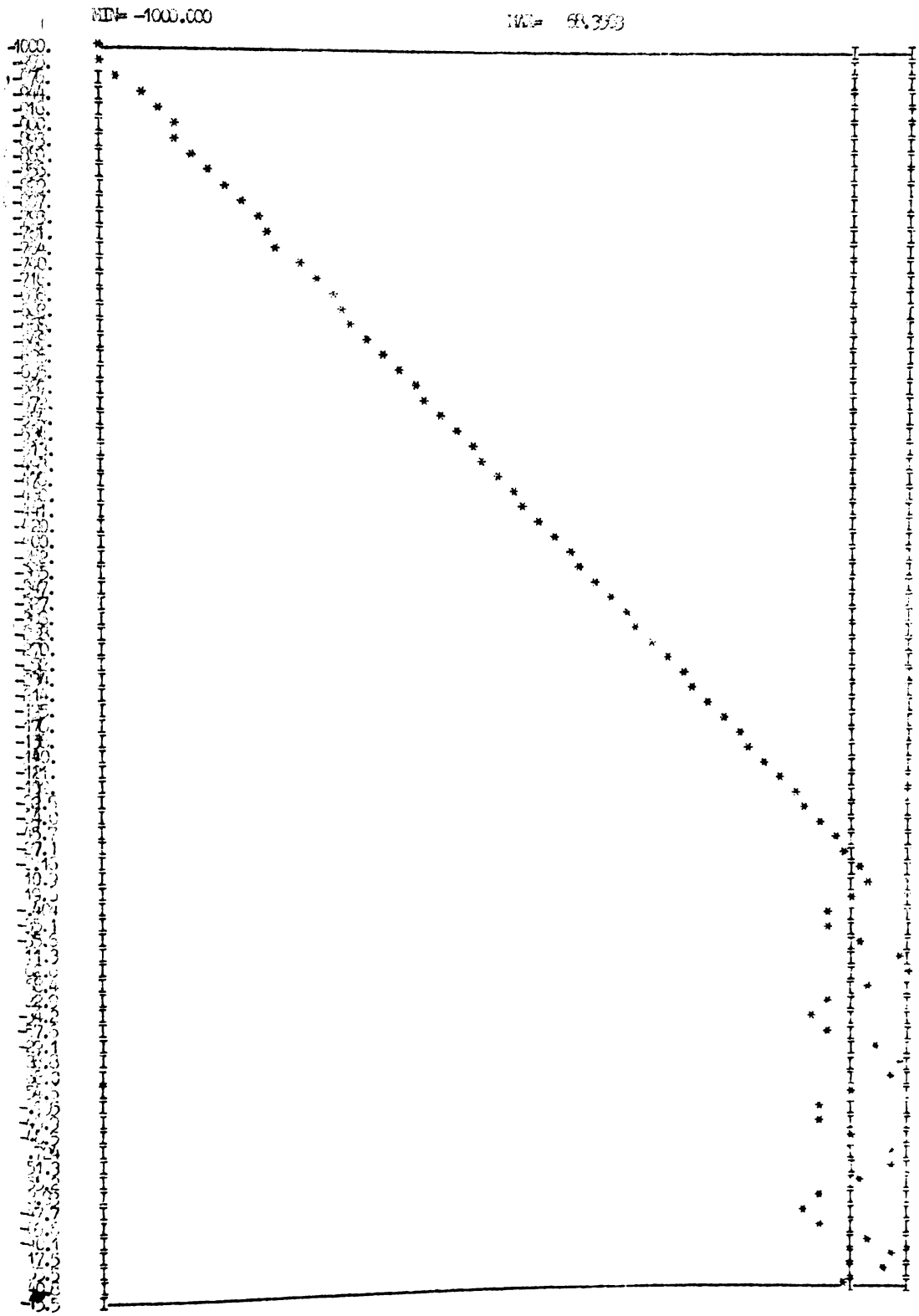
-referinta de pozitie : treapta cu amplitudinea w = 1000

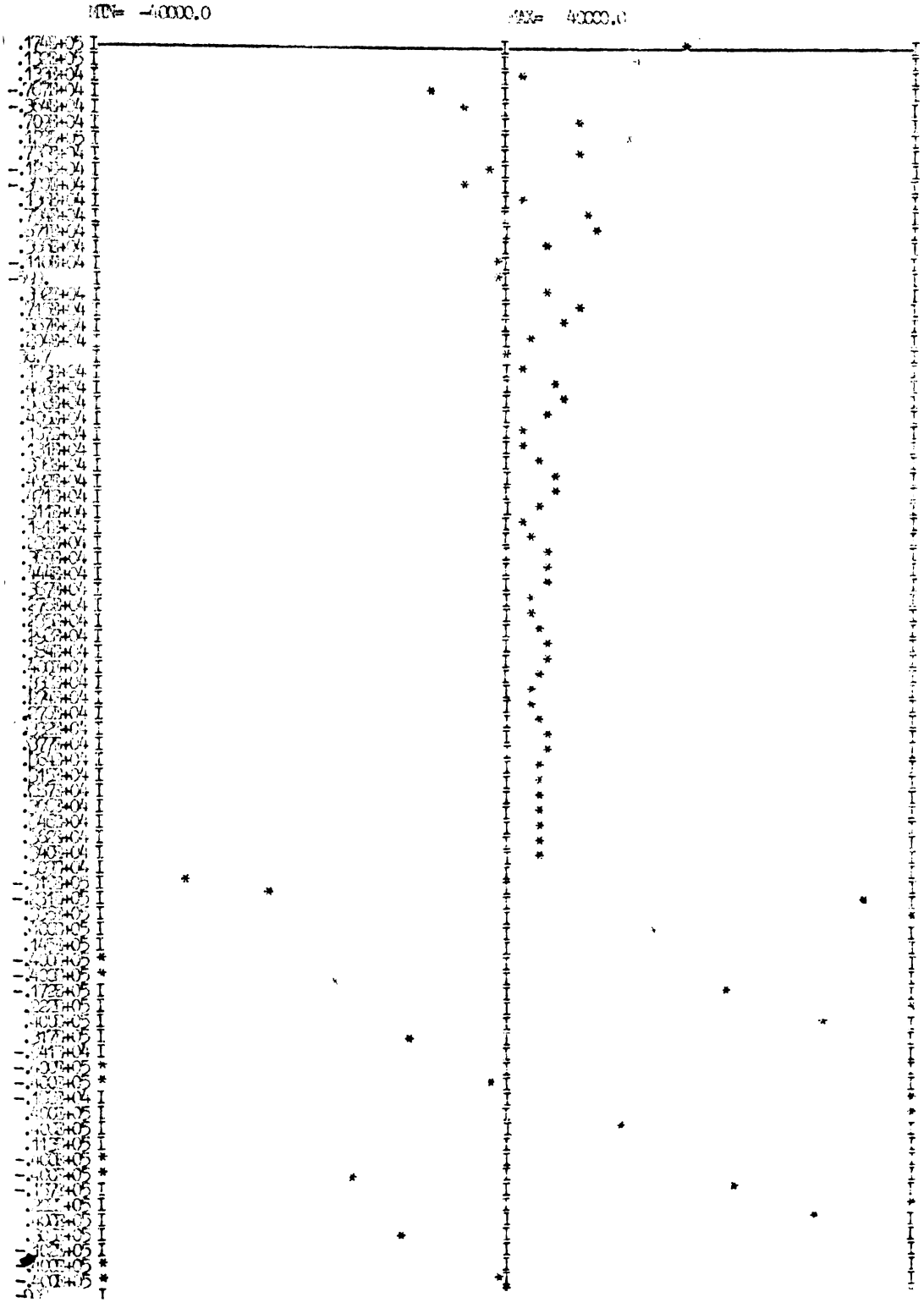
-perturbatia simulata : up = 0



OMEGA







Rezultatele programului de SIMULARE

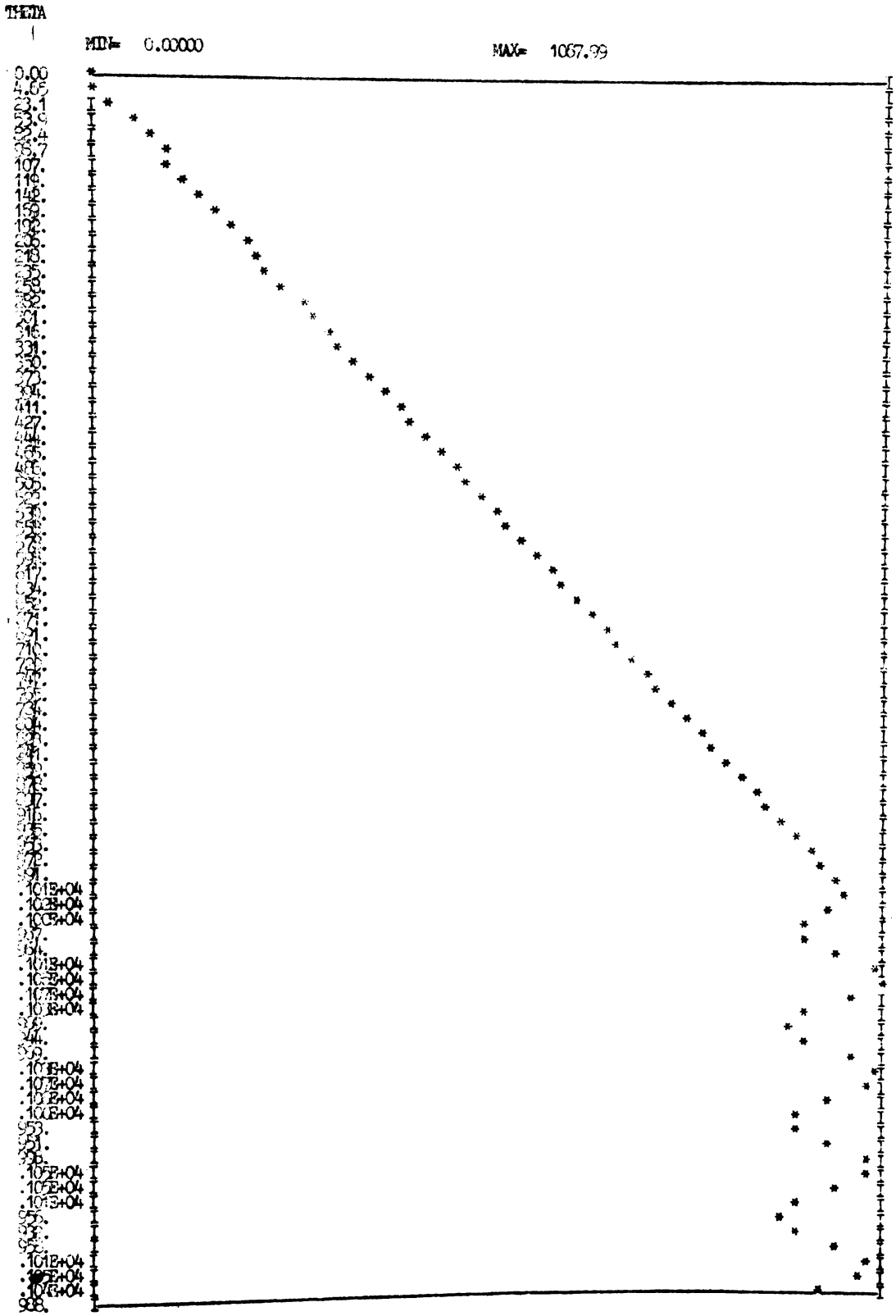
-algoritm de reglare : tip ARMA - 2
fara compensarea perturbatiilor
cu limitarea modulului comenzii
b1 = 7.81E-4
b2 = 6.10E-7
P = 1500

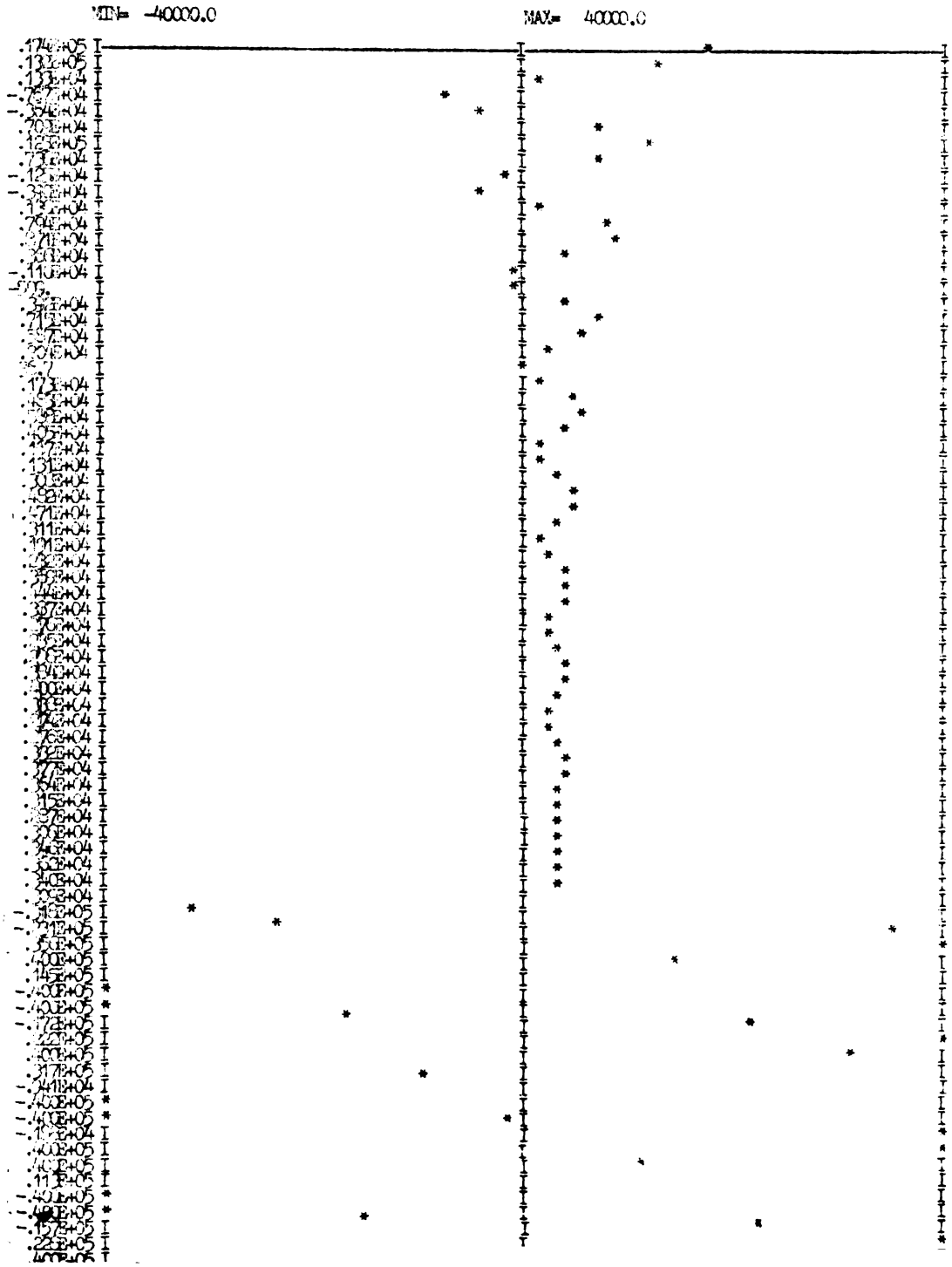
-modelul procesului condus extins : PCE - 2

-perioada de esantionare : Te = 12.5 msec

-referinta de pozitie : treapta cu amplitudinea w = 1000

-perturbatia simulata : up = 0





Rezultatele programului de SIMULARE

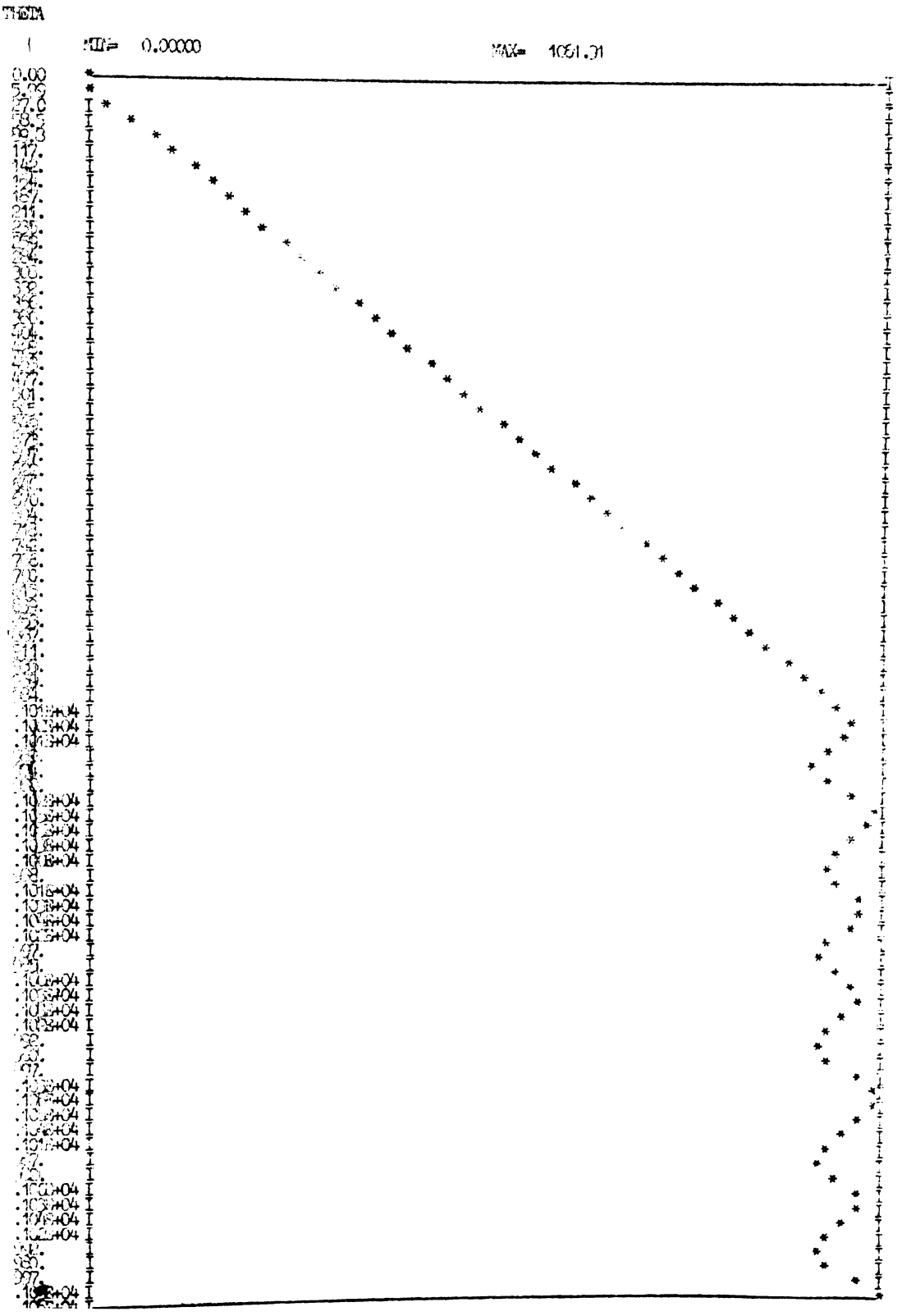
-algoritm de reglare : tip ARMA - 2
cu compensarea perturbatiilor
cu limitarea modulului comenzii
b1 = 7.81E-4
g2 = 6.10E-7
P = 1500

-modelul procesului condus extins : PCE - 2

-perioada de esantionare : Te = 12.5 msec

-referinta de pozitie : treapta cu amplitudinea w = 1000

-perturbatia simulata : up = 0



Rezultatele programului de SIMULARE

-algoritm de reglare : tip ARMA - 2
cu compensarea perturbatiilor
cu limitarea modulului comenzii
b1 = 7.81E-4
b2 = 6.10E-7
P = 1500

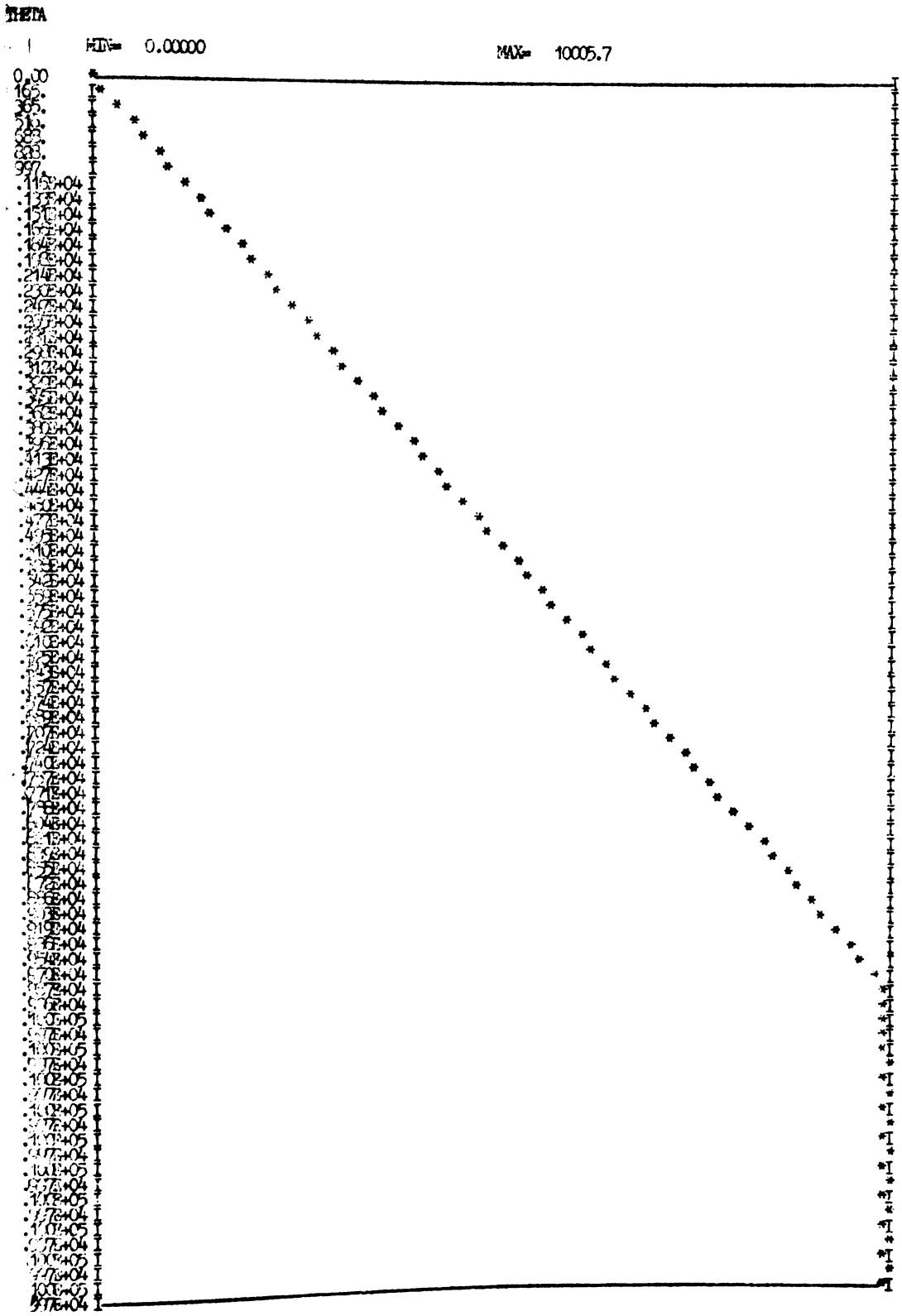
-modelul procesului condus extins : PCE - 2

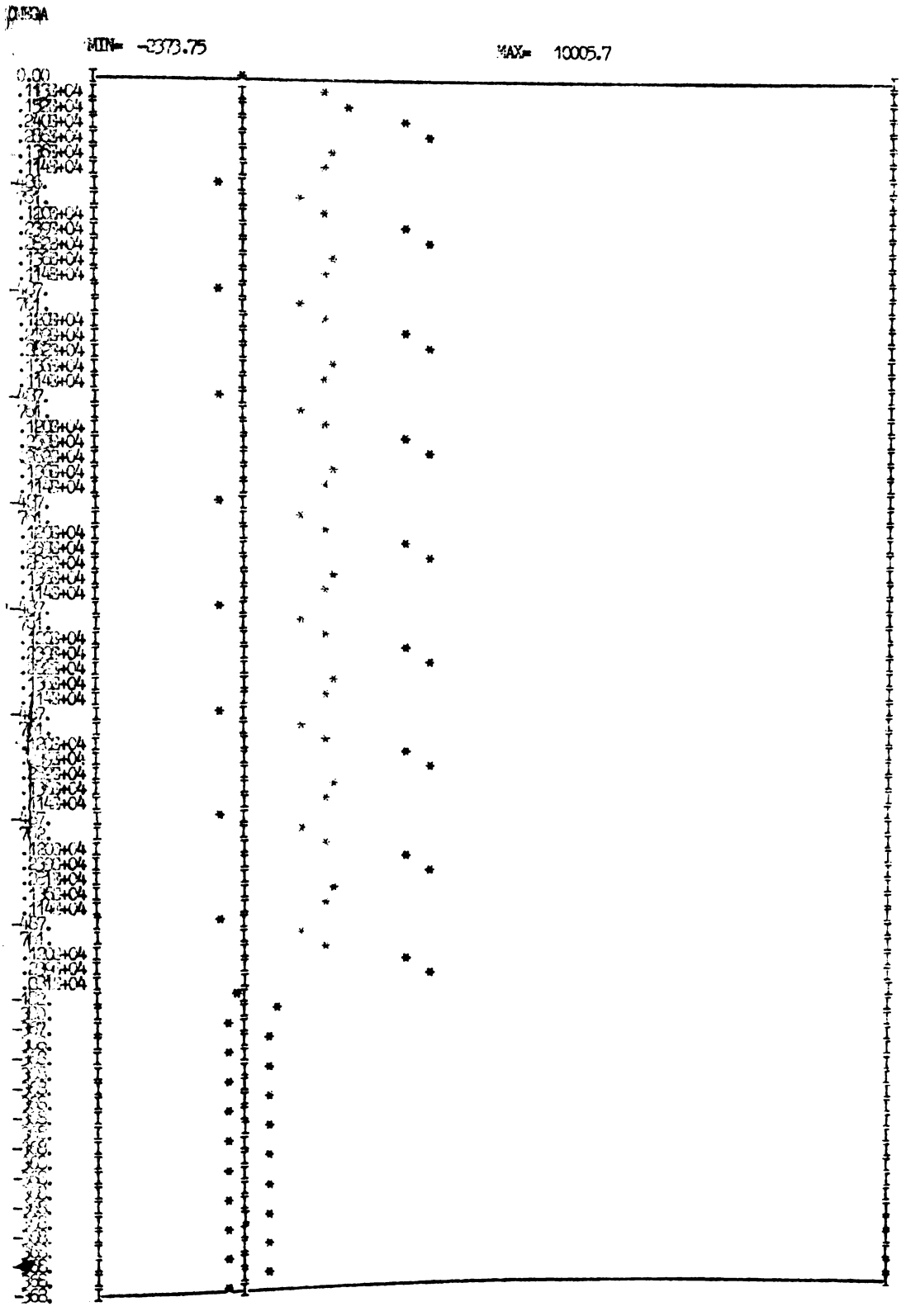
-perioada de esantionare : Te = 12.5 msec

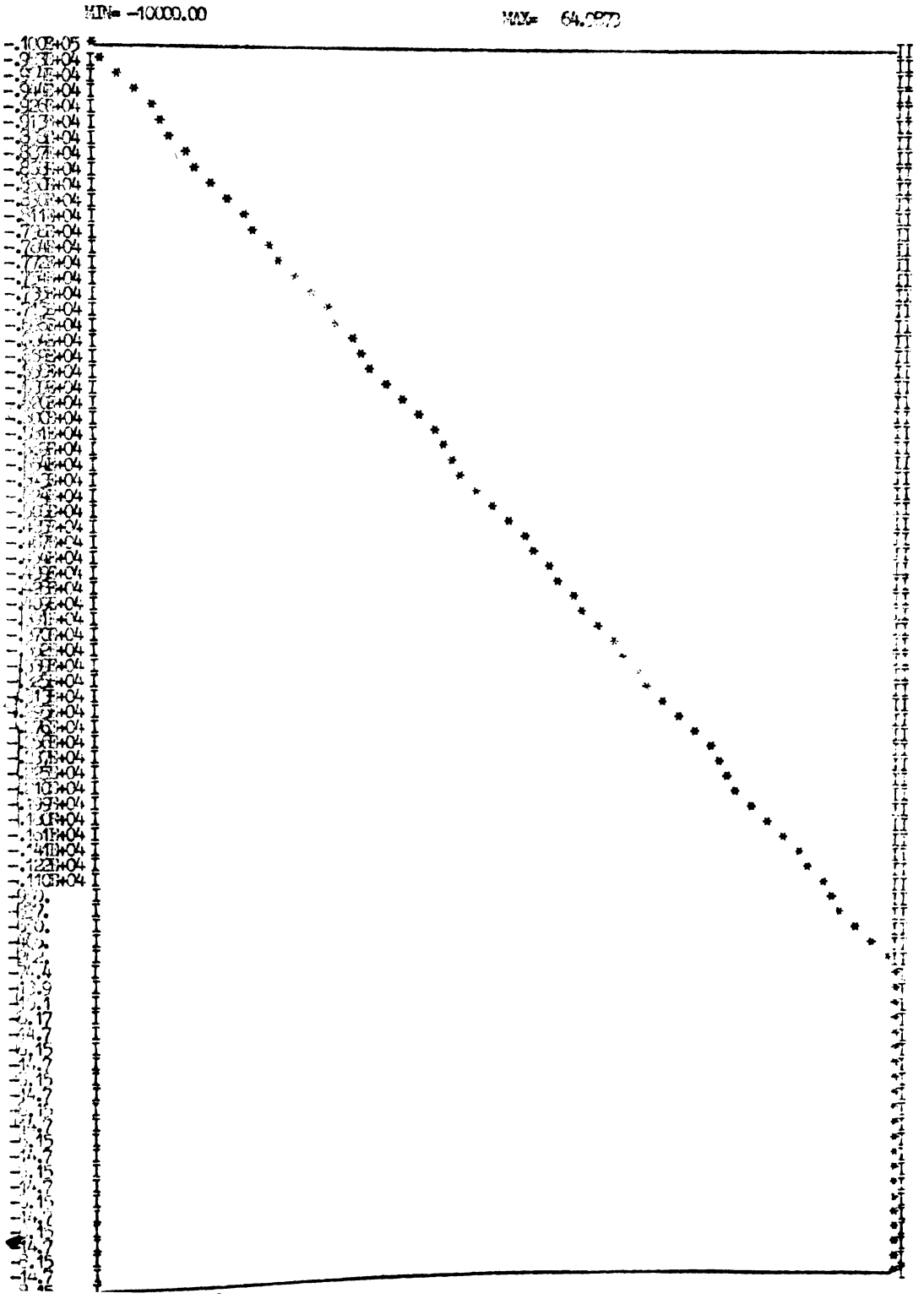
-referinta de pozitie : treapta cu amplitudinea w = 10000

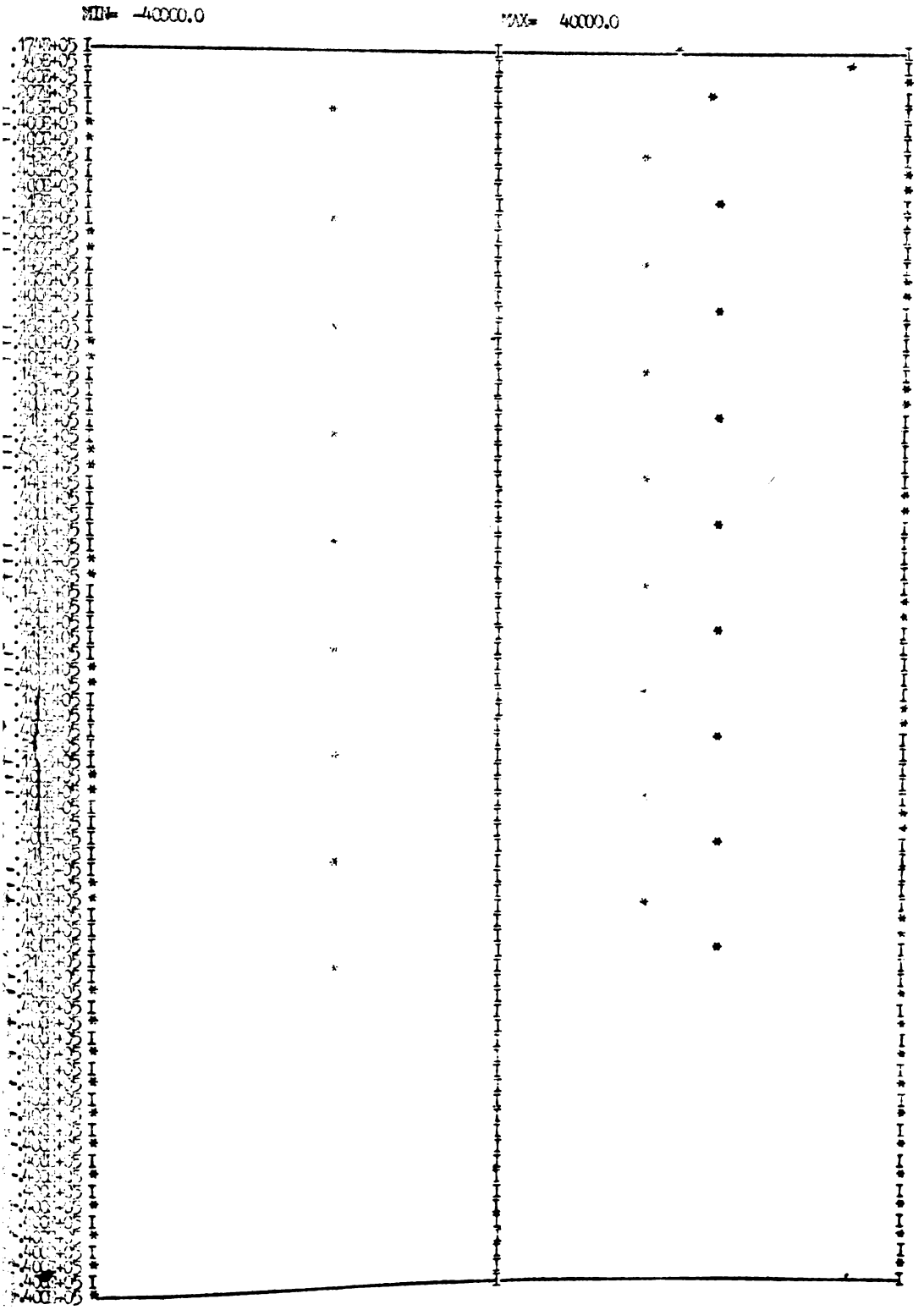
-perturbatia simulata : up = 0

obs. in grafice sint reprezentate valorile esantioanelor din 10 in 10, astfel incit o linie corespunde unui interval de timp 10*Te = 125 msec









ANEXA A7

PROGRAMUL DE IMPLEMENTARE CONCRETA A METODEI DE REGLARE NELINIARA MODAL-ALOCATOARE A INERTIEI PENTRU UN SISTEM DE ACTIONARE CU MOTOR DE CURENT CONTINUU

1. Executivul de timp real (RTE)
2. Subprogramul de implementare a algoritmului ARMA-1
   -cu neglijarea inertiei producerii actiunii ponderomotoare
3. Subprogramul de implementare a algoritmului ARMA-2
   -cu luarea in considerare a inertiei producerii actiunii ponderomotoare
4. Subprogramele din biblioteca matematica.

```
MACRO-80 3.44  09-Dec-8'        PAGE

                                NAME    ('ETR')
                                EXT     ARNT
                                PUBLIC  TK,WK,UK,US,START,ETR
                        ;
                                ORG     2016H
2016'                   ADIN:   DS      6       ;buffer caractere de la DAF
201C'                   ADAD:   DS      2       ;pointer buffer caractere
201E'                   TABI:   DS      10      ;tabel intreruperi
2028'                   ADTAB:  DS      2       ;pointer tabel intreruperi
202A'                   SC:     DS      1       ;fanion sfirsit cuanta de
                                                ;esantionare
202B'                   SR:     DS      1       ;fanion sfirsit receptie
202C'                   TK:     DS      2       ;theta(k)
202E'                   WK:     DS      2       ;w(k)
2030'                   UK:     DS      2       ;modul u(k)
2032'                   US:     DS      1       ;semn u(k)
                                ORG     20E9H
20E9'                   START:  DS      1       ;fanion pornire (pentru TEST)
                        ;
                        ;subrutine monitor
4336                    IN8R    EQU     4336H   ;A(DAF)->B(ASCII)
4437                    OUT8Q   EQU     4437H   ;A(ASCII)->DAF
4441                    CRLF    EQU     4441H   ;<CR>,<LF>->DAF
4534                    ADEC    EQU     4534H   ;conversie sir cifre zecimale
                                                ;(ASCII)->hexa
                                PAGE
```

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```
                        ;
                        ;program principal ETR
                        ;---- ----------------
                        ;
                        ;salt intrerupere DAF
                                ORG     8400H
8400'  C3 0151"                 JMP     IDAF
                        ;initializari
                                ORG     8800H
                        ;
8800'  CD 4441          ETR:    CALL    CRLF
8803'  3E 45                    MVI     A,'E'
8805'  CD 4437                  CALL    OUT8Q
8808'  CD 4441                  CALL    CRLF    ;semnalizeaza Executie
880B'  31 0000                  LXI     SP,0    ;origine stiva
880E'  21 8400                  LXI     H,8400H
8811'  22 20C9                  SHLD    20C9H   ;salt intrerupere DAF
                        ;
8814'  AF                       XRA     A
8815'  D3 02                    OUT     2
8817'  D3 03                    OUT     3
8819'  3E 01                    MVI     A,1
881B'  D3 28                    OUT     28H
881D'  3E 02                    MVI     A,2
881F'  D3 0A                    OUT     10      ;programare porturi
8821'  D3 08                    OUT     8
8823'  AF                      XRA     A
8824'  D3 08                    OUT     8       ;CLEAR numarator
                        ;
8826'  21 2016'                 LXI     H,ADIN
8829'  22 201C'                 SHLD    ADAD    ;initializare pointer buffer
                                                ;caractere
                        ;
882C'  06 1D                    MVI     B,29
882E'  05               PR1:    DCR     B
882F'  77                       MOV     M,A
8830'  23                       INX     H
8831'  C2 882E'                JNZ     PR1     ;initializare variabile cu 2
8834'  C3 2033'         PRC:    JMP     POZ     ;in SRAM
                        ;preluare pozitie curenta
                                ORG     2033H
2033'  DB 00            POZ:    IN      0
2035'  6F                       MOV     L,A
2036'  DB 01                    IN      1
2038'  67                       MOV     H,A
2039'  DB 01                    IN      1
203B'  BC                       CMP     H
203C'  CA 2042'                 JZ      POZ1
203F'  DB 01                    IN      1
2041'  67                       MOV     H,A
2042'  DB 00            POZ1:   IN      0
2044'  BD                       CMP     L
2045'  C2 2033'                 JNZ     POZ
2048'  22 202C'                 SHLD    TK
```

```
204B'  C3 0000"                    JMP     PR2     ;in DRAM
                                ;
                                ;constructie tabel intreruperi
204E'                           PR2:    DSEG
0000"  3A 2031'                 PR2:    LDA     UK+1
0003"  FE 3C                            CPI     3CH
0005"  DA 0086"                         JC      PR3
0008"  FE 78                            CPI     78H
000A"  DA 004F"                         JC      PR4
000D"  FE 96                            CPI     96H
000F"  DA 0018"                         JC      PR5
0012"  21 9600                          LXI     H,9600H ;u(k)>9600H
0015"  22 2030'                         SHLD    UK
0018"  3E 3C                    PR5:    MVI     A,3CH   ;7800H < !u(k)! < 9600H
001A"  C6 80                            ADI     80H
001C"  D3 2D                            OUT     2DH
001E"  AF                               XRA     A
001F"  D3 2C                            OUT     2CH     ;timer <- 3C00H
0021"  AF                               XRA     A
0022"  32 201E'                         STA     TABI
0025"  32 2021'                         STA     TABI+3
0028"  3C                               INR     A
0029"  32 2027'                         STA     TABI+9
002C"  3C                               INR     A
002D"  32 2024'                         STA     TABI+6
0030"  21 3C00                          LXI     H,3C00H
0033"  22 201F'                         SHLD    TABI+1
0036"  2A 2030'                         LHLD    UK
0039"  11 7800                          LXI     D,7800H
003C"  CD 20EA"                         CALL    ULIDE
003F"  22 2022'                         SHLD    TABI+4  ;!u(k)!-7800H
0042"  EB                               XCHG
0043"  21 1E00                          LXI     H,1E00H
0046"  CD 20EA"                         CALL    ULIDE   ;9600H-!u(k)!
0049"  22 2025'                         SHLD    TABI+7
004C"  C3 00BF"                         JMP     PR6
004F"  3E 3C                    PR4:    MVI     A,3CH   ;3C00H < !u(k)! < 7800H
0051"  C6 80                            ADI     80H
0053"  D3 2D                            OUT     2DH
0055"  AF                               XRA     A
0056"  D3 2C                            OUT     2CH     ;timer <- 3C00H
0058"  AF                               XRA     A
0059"  32 201E'                         STA     TABI
005C"  32 2024'                         STA     TABI+6
005F"  3C                               INR     A
0060"  32 2027'                         STA     TABI+9
0063"  3C                               INR     A
0064"  32 2021'                         STA     TABI+3
0067"  21 1E00                          LXI     H,1E00H
006A"  22 2025'                         SHLD    TABI+7
006D"  2A 2030'                         LHLD    UK
0070"  11 3C00                          LXI     D,3C00H
0073"  CD 20EA"                         CALL    ULIDE
0076"  22 201F'                         SHLD    TABI+1  ;!u(k)!-3C00H
0079"  EB                               XCHG
007A"  21 3C00                          LXI     H,3C00H
```

```
007D"  CD 20EA"              CALL    HLMDS
0080"  22 2022'              SHLD    TABI+4  ;7800H-!u(k)!
0083"  C3 00BF"              JMP     PR6
0086"  3A 2031'      PR3:    LDA     UK+
0089"  C6 80                 ADI     80H
008B"  D3 2D                 OUT     2DH
008D"  3A 2030'              LDA     UK
0090"  FE 0A                 CPI     10
0092"  DA 0094"              JC      $+2
0095"  3E 0A                 MVI     A,10    ;limitare !u(k)! > 10
0097"  D3 2C                 OUT     2CH     ;timer <- !u(k)!
0099"  AF                    XRA     A
009A"  32 2021'              STA     TABI+3
009D"  32 2024'              STA     TABI+6
00A0"  3C                    INR     A
00A1"  32 2027'              STA     TABI+9
00A4"  3C                    INR     A
00A5"  32 201E'              STA     TABI
00A8"  21 1E00               LXI     H,1E00H
00AB"  22 2025'              SHLD    TABI+7
00AE"  21 3C00               LXI     H,3C00H
00B1"  22 2022'              SHLD    TABI+4
00B4"  EB                    XCHG
00B5"  2A 2030'              LHLD    UK
00B8"  EB                    XCHG
00B9"  CD 20EA"              CALL    HLMDE
00BC"  22 201F'              SHLD    TABI+   ;3C00H-!u(k)!
00BF"  21 201E'      PR6:    LXI     H,TABI
00C2"  22 2028'              SHLD    ADTAB   ;initializare pointer tabel
                                             ;intreruperi
                     ;start chopper
00C5"  3A 2032'              LDA     US
00C8"  B7                    ORA     A
00C9"  3E 04                 MVI     A,4
00CB"  CA 00D0"              JZ      PR7
00CE"  C6 04                 ADI     4
00D0"  D3 29         PR7:    OUT     29H
                     ;validare intreruperi
00D2"  3E 09                 MVI     A,9
00D4"  30                    DB      30H     ;codul instructiunii SIM
                     ;start timer
00D5"  3E C1                 MVI     A,0C1H
00D7"  D3 28                 OUT     28H
00D9"  FB                    EI
                     ;apelare ARN
00DA"  CD 0000*              CALL    ARNT
00DD"  76            PR8:    HLT
                     ;testare fanion
00DE"  3A 202A'              LDA     SC
00E1"  B7                    ORA     A
00E2"  CA 00DD"              JZ      PR8
00E5"  AF                    XRA     A
00E6"  32 202A'              STA     SC
00E9"  3A 2023'              LDA     SR
00EC"  B7                    ORA     A
00ED"  CA 2033'              JZ      POZ
```

```
00F0"   AF                      XRA     A
00F1"   32 202B'                STA     SR
                        ;prelucrare w(k)
00F4"   01 2016'                LXI     B,ADIN
00F7"   21 2016'                LXI     H,ADIN
00FA"   22 201C'                SHLD    ADAD    ;initializare pointer
00FD"   CD 4534                 CALL    ADEC    ;conversie ASCII->hexa
0100"   E5                      PUSH    H
0101"   22 202E'                SHLD    WK
0104"   7C                      MOV     A,H
0105"   CD 456D                CALL    456DH
0108"   E1                      POP     H
0109"   7D                      MOV     A,L
010A"   CD 456D                CALL    456DH
010D"   3E 48                  MVI     A,'H'
010F"   CD 4437                CALL    OUT8Q
0112"   CD 4441                CALL    CRLF    ;ecou w(k)
0115"   C3 2033'        BETR:   JMP     POZ
                        PAGE
```

```
                                ;
                                ;subrutina tratare intrerupere TIMER (RST 5.5)
                                ;------ ------------------------------------
                                ;
                                        ORG     20CEH
20CE"   C3 0118"                        JMP     ITIM    ;salt intrerupere
                                ;
                                        ORG     EETR+3
0118"   F5                      ITIM:   PUSH    PSW
0119"   E5                              PUSH    H
                                ;testare tip eveniment
011A"   2A 2028'                        LHLD    ADTAB
011D"   7E                              MOV     A,M
011E"   1F                              RAR
011F"   DA 0149"                        JC      IT1
0122"   1F                              RAR
0123"   D2 0129"                        JNC     IT2
                                ;stop chopper
0126"   AF                              XRA     A
0127"   D3 29                           OUT     29H
                                ; incrementare timer
0129"   23                      IT2:    INX     H
012A"   7E                              MOV     A,M
012B"   FE 0A                           CPI     10
012D"   DA 012F"                        JC      $+2
0130"   3E 0A                           MVI     A,10    ;limitare !u(k)! > 10
0132"   D3 2C                           OUT     2CH
0134"   23                              INX     H
0135"   7E                              MOV     A,M
0136"   C6 80                           ADI     80H
0138"   D3 2D                           OUT     2DH
013A"   23                              INX     H
013B"   22 2028'                        SHLD    ADTAB   ;valoarea incrementata a
                                                        ;pointerului
                                ;validare intreruperi
013E"   3E 09                          MVI     A,9
0140"   30                              DB      30H     ;codul instructiunii SIM
0141"   FB                              EI
                                ;start timer
0142"   E1                              POP     H
0143"   3E C1                           MVI     A,0C1H
0145"   D3 28                           OUT     28H
0147"   F1                              POP     PSW
0148"   C9                              RET
0149"   3E 01                   IT1:    MVI     A,1
014B"   32 202A'                        STA     SC
014E"   E1                              POP     H
014F"   F1                              POP     PSW
0150"   C9                              RET
                                        PAGE
```

```
                                ;
                                ;subrutina tratare intrerupere DAF (RST 7.5)
                                ;
0151"   F5                      IDAF:   PUSH    PSW
0152"   C5                              PUSH    B
0153"   E5                              PUSH    H
0154"   2A 201C'                        LHLD    ADAD    ;pointer
0157"   3A 7000                         LDA     7000H
015A"   CD 4336                         CALL    IN8R    ;preluare caracter
015D"   78                              MOV     A,B
015E"   FE 0D                           CPI     13      ;<CR>
0160"   CA 018F"                        JZ      ED1
0163"   FE 53                           CPI     'S'
0165"   CA 019E"                        JZ      ED4
0168"   FE 51                           CPI     'Q'
016A"   CA 430C                         JZ      430CH
016D"   FE 18                           CPI     24      ;<CLEAR>
016F"   C2 0178"                        JNZ     ED2
0172"   CD 4437                         CALL    OUT8Q
0175"   C3 018A"                        JMP     ED3
0178"   FE 30                   ED2:    CPI     30H
017A"   DA 018A"                        JC      ED3
017D"   FE 3A                           CPI     3AH
017F"   D2 018A"                        JNC     ED3     ;testare cifra
0182"   CD 4437                         CALL    OUT8Q   ;ecou
0185"   70                              MOV     M,B
0186"   23                              INX     H
0187"   22 201C'                        SHLD    ADAD    ;pointer incrementat
018A"   E1                      ED3:    POP     H
018B"   C1                              POP     B
018C"   F1                              POP     PSW
018D"   FB                              EI
018E"   C9                              RET
018F"   3E 3D                   ED1:    MVI     A,'='   ;<CR>
0191"   CD 4437                         CALL    OUT8Q
0194"   36 00                           MVI     M,0
0196"   3E 01                           MVI     A,1
0198"   32 202B'                        STA     SR
019B"   C3 018A"                        JMP     ED3
019E"   3E 01                   ED4:    MVI     A,1     ;'S'
01A0"   32 20E9'                        STA     START
01A3"   CD 4441                         CALL    CRLF
01A6"   3E 53                           MVI     A,'S'
01A8"   CD 4437                         CALL    OUT8Q
01AB"   CD 4441                         CALL    CRLF    ;semnalizeaza Start
01AE"   C3 018A"                        JMP     ED3
                                ;subrutina scadere
                                        ORG     20EAH
20EA"   7D                      HLMDE:  MOV     A,L
20EB"   93                              SUB     E
20EC"   6F                              MOV     L,A
20ED"   7C                              MOV     A,H
20EE"   9A                              SBB     D
20EF"   67                              MOV     H,A
```

```
20F0"   09                      RET
                                END
```

Macros:

Symbols:

201C'	ADAD	4534	ADEC	2016'	ADIN
2028'	ADTAB	00DB*	ARNT	4441	CRLF
018F"	ED1	0178"	ED2	018A"	ED3
019E"	ED4	0115"	EETR	8800I'	ETR
20EA"	HLMDE	0151"	IDAF	4336	IN8R
0149"	IT1	0129"	IT2	0118"	ITIM
4437	OUT8Q	2033'	POZ	2042'	POZ1
882E'	PR1	0000"	PR2	0086"	PR3
004F"	PR4	0018"	PR5	00BF"	PR6
00D0"	PR7	00DD"	PR8	8834'	PRC
202A'	SC	202B'	SR	20E9I'	START
201E'	TABI	202C1'	TK	2030I'	UK
2032I'	US	202EI'	WK		

No Fatal error(s)

```
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                                  NAME    ('ARMA1')
                                ;
                                ;algorithm ARMA-1
                                ;
                                  PUBLIC  ARMA1,K2,K3,K4
                                  PUBLIC  TK1,T1K1,UK1,VK2T,T1K
                                  EXT     MUL12,CPL3,MUL12M,CPL2,ADD3V,ADD3
                                  EXT     ROT3R,DIF2,COMP2,ROT3LV,WK,TK,UK,US
0000'                             DSEG
                                ;variabile
0000"                           TK1:    DS      2       ;theta(k-1)
0002"                           T1K:    DS      2       ;omega(k)
0004"                           T1K1:   DS      2       ;omega(k-1)
0006"                           UK1:    DS      3       ;u(k-1)
0009"                           VK2T:   DS      3       ;v~(k-2)
                                ;parametri
000C"  0040                     K2:     DW      64      ;3.2*C
000E"  0FAC                     K3:     DW      4000    ;0.1*P
0010"  000A                     K4:     DW      10      ;-0.514*C
                                  PAGE
```

```
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0012"                           CSEG
                        ;program
0000'   2A 0000*        ARMA1:  LHLD    TK
0003'   EB                      XCHG
0004'   2A 0000"                LHLD    TK1
0007'   CD 0000*                CALL    DIF2    ;DE=omega(k)=theta(k)-
                                                ; -theta(k-1)
000A'   2A 0000*                LHLD    TK
000D'   22 0000"                SHLD    TK1     ;theta(k-1) <- theta(k)
0010'   EB                      XCHG
0011'   22 0002"                SHLD    T1K
0014'   EB                      XCHG
0015'   2A 0004"                LHLD    T1K1
0018'   CD 0000*                CALL    DIF2    ;DE=omega1(k)=omega(k)-
                                                ; -omega(k-1)
001B'   2A 0002"                LHLD    T1K
001E'   22 0004"                SHLD    T1K1    ;omega(k-1) <- omega(k)
0021'   42                      MOV     B,D
0022'   63                      MOV     H,E
0023'    2E  00                 MVI     L,0         ;BHL=omega1(k)*2^8
0025'   4A                      MOV     C,D
0026'   53                      MOV     D,E
0027'    5D                     MOV     E,L         ;CDE=omega1(k)*2^8
0028'   CD 0000*                CALL    ADD3V       ;BHL=omega1(k)*2^9
002B'    CD 0000*               CALL    ROT3R       ;CDE=omega1(k)*2^7
002E'   CD 0000*                CALL    ADD3V       ;BHL=omega(k)*(2^7+2^9)
0031'    CD 0000*               CALL    CPL3        ;BHL=-omega(k)*(2^7+2^9)
0034'   EB                      XCHG
0035'    48                     MOV     C,B         ;CDE=-omega(k)*(2^7+2^9)
0036'   2A 0006"                LHLD    UK1
0039'   3A 0008"                LDA     UK1+2
003C'   47                      MOV     B,A         ;BHL=u(k-1)
003D'   CD 0000*                CALL    ADD3V       ;BHL=v(k-1)
0040'   EB                      XCHG
0041'   48                      MOV     C,B         ;CDE=v(k-1)
0042'   21 0000                 LXI     H,0
0045'   06 00                   MVI     B,0         ;BHL=0
0047'   CD 0000*                CALL    ROT3R
004A'   CD 0000*                CALL    ADD3
004D'   CD 0000*                CALL    ROT3R
0050'   CD 0000*                CALL    ROT3R
0053'    CD 0000*               CALL    ADD3        ;BHL=v(k-1)*(2^-1+2^-3)
0056'   EB                      XCHG
0057'   2A 0009"                LHLD    VK2T
005A'   EB                      XCHG
005B'   3A 000B"                LDA     VK2T+2
005E'   4F                      MOV     C,A         ;CDE=v~(k-2)
005F'   CD 0000*                CALL    ROT3R
0062'   CD 0000*                CALL    ROT3R
0065'   CD 0000*                CALL    ADD3
0068'   CD 0000*                CALL    ROT3R
006B'   CD 0000*                CALL    ADD3        ;BHL=v~(k-1)
006E'   22 0009"                SHLD    VK2T
0071'   78                      MOV     A,B
```

```
0072'  32 000B"                    STA     VK2T+2      ;v~(k-2) <- v~(k-1)
0075'  2A 0000*                    LHLD    TK
0078'  EB                          XCHG                ;DE=theta(k)
0079'  2A 0000*                    LHLD    WK          ;HL=w(k)
007C'  CD 0000*                    CALL    COMP2
007F'  D2 0083'                    JNC     ARN1        ;theta(k) > w(k)
0082'  EB                          XCHG                ;face DE > HL
0083'  F5                  ARN1:   PUSH    PSW         ;CY=1 daca e(k) < 0
0084'  CD 0000*                    CALL    DIF2        ;DE= !e(k)!
0087'  3A 000C"                    LDA     K2
008A'  4F                          MOV     C,A
008B'  CD 0000*                    CALL    MUL12       ;BHL=K2*!e(k)! > 0
008E'  6C                          MOV     L,H
008F'  60                          MOV     H,B
0090'   06  00                     MVI     B,0         ;BHL=K2*!e(k)!*2^-8
0092'  F1                          POP     PSW         ;CY=1 daca e(k) < 0
0093'   DC 0000*                   CC      CPL3        ;BHL=K2*e(k)*2^-8
0096'  EB                          XCHG
0097'   48                         MOV     C,B         ;CDE=K2*e(k)*2^-8
0098'  2A 0002"                    LHLD    T1K         ;HL=omega(k)
009B'  7C                          MOV     A,H
009C'  17                          RAL                 ;CY=1 daca HL < 0
009D'  3E 00                       MVI     A,0
009F'  D2 00A3'                    JNC     ARN2
00A2'  2F                          CMA
00A3'  47                  ARN2:   MOV     B,A         ;BHL=omega(k)
00A4'  CD 0000*                    CALL    ADD3    ;BHL=s(k)
00A7'  78                          MOV     A,B
00A8'  17                          RAL                 ;CY=1 daca s(k) < 0
00A9'  F5                          PUSH    PSW
00AA'  2A 0002"                    LHLD    T1K
00AD'  EB                          XCHG                ;DE=omega(k)
00AE'  3A 0010"                    LDA     K4
00B1'  4F                          MOV     C,A
00B2'  CD 0000*                    CALL    MUL12       ;BHL=K4*omega(k)
00B5'  CD 0000*                    CALL    CPL3
00B8'  5D                          MOV     E,L
00B9'  54                          MOV     D,H
00BA'  48                          MOV     C,B         ;CDE=K4*omega(k)
00BB'  CD 0000*                    CALL    ROT3LV
00BE'  CD 0000*                    CALL    ROT3LV
00C1'  CD 0000*                    CALL    ROT3LV
00C4'  CD 0000*                    CALL    ROT3LV      ;CDE=K4*omega(k)*2^
00C7'  2A 000E"                    LHLD    K3
00CA'  06 00                       MVI     B,0         ;BHL=K3
00CC'  F1                          POP     PSW         ;CY=1 daca s(k) < 0
00CD'  D5                          PUSH    D
00CE'   D4 0000*                   CNC     CPL3        ;BHL=-K3*sgn{s(k)}
00D1'  D1                          POP     D
00D2'  CD 0000*                    CALL    ADD3V   ;BHL=omega1D(k)
00D5'  EB                          XCHG
00D6'  48                          MOV     C,B         ;CDE=omega1D(k)
00D7'  2A 0009"                    LHLD    VK2T
00DA'  3A 000B"                    LDA     VK2T+2
00DD'  47                          MOV     B,A         ;BHL=v~(k-2)
00DE'  CD 0000*                    CALL    ADD3V   ;BHL=u(k)
```

```
00E1' 22 0006"                  SHLD    UK1
00E4' 78                        MOV     A,B
00E5' 32 0008"                  STA     UK1+2   ;u(k-1) <- u(k)
00E8' 17                        RAL
00E9' 3E 00                     MVI     A,0
00EB' 17                        RAL             ;A=1 daca u(k) < 0
00EC' 32 0000*                  STA     US
00EF' 1F                        RAR
00F0' DC 0000*                  CC      CPL3        ;BHL=!u(k)!
00F3' 78                        MOV     A,B
00F4' B7                        ORA     A
00F5' CA 00FB'                  JZ      ARN3
00F8' 21 FFFF                   LXI     H,0FFFFH        ;limitare superioara
                                                        ; !u(k)!
00FB' 22 0000*          ARN3:   SHLD    UK
00FE' C9                        RET
                                END
```

Macros:

Symbols:

00A5*	ADD3	00DF*	ADD3V	0000I'	ARMA1
0083'	ARM1	00A3'	ARN2	00FB'	ARN3
007D*	COMP2	0000*	CPL2	00F1*	CPL3
0085*	DIF2	00C1"	K2	00CEI"	K3
0010I"	K4	00B3*	MUL'2	0000*	MUL12M
00C5*	ROT3LV	0069*	ROT3R	0002I"	T1K
0004I"	T1K1'	0076*	TK	0000I"	TK1
00FC*	UK	0006I"	UK1	00ED*	US
0009I"	VK2T	007A*	WK		

No Fatal error(s)

```
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                                NAME    ('ARM2')
                        ;
                        ;algoritm ARMA-2
                        ;
                                PUBLIC  ARMA2,K1
                                PUBLIC  T2K1
                                EXT     TK,WK,UK,US
                                EXT     UK1,T1K,T1K1,TK1,VK2T
                                EXT     MUL12,CPL3,MUL121,CPL2,ADD3V,ADD3
                                EXT     ROT3R,DIF2,COMP2,ROT3LV
                        ;parametri
0000'                           DSEG
0000"   003C           K1:     DW      60      ;0.0125*P
                        ;variabile
0002"                   T2K:    DS      2       ;theta2(k)
0004"                   T3K:    DS      2       ;theta3(k)
0006"                   T2K1:   DS      2       ;theta2(k-1)
0008"                   T1DK:   DS      3       ;theta1D(k)
000B"                   T2DK:   DS      3       ;theta2D(k)
                                PAGE
```

```
                                        ;program
000E"                                   CSEG
0000'   2A 0000*                ARMA2:  LHLD    TK
0003'   EB                              XCHG
0004'   2A 0000*                        LHLD    TK1
0007'   CD 0000*                        CALL    DIF2    ;DE=theta1(k)
000A'   2A 0000*                        LHLD    TK
000D'   22 0000*                        SHLD    TK1     ;theta(k-1) <
- theta(k)
0010'   EB                              XCHG
0011'   22 0000*                        SHLD    T1K
0014'   EB                              XCHG
0015'   2A 0000*                        LHLD    T1K1
0018'   CD 0000*                        CALL    DIF2    ;DE=theta2(k)
001B'   2A 0000*                        LHLD    T1K
001E'   22 0000*                        SHLD    T1K1    ;theta1(k-1) <- theta1(k)
0021'   EB                              XCHG
0022'   22 0002"                        SHLD    T2K
0025'   EB                              XCHG
0026'   2A 0006"                        LHLD    T2K1
0029'   CD 0000*                        CALL    DIF2    ;DE=theta3(k)
002C'   2A 0002"                        LHLD    T2K
002F'   22 0006"                        SHLD    T2K1    ;theta2(k-1) <- theta2(k)
0032'   EB                              XCHG
0033'   22 0004"                        SHLD    T3K
0036'   4C                              MOV     C,H
0037'   55                              MOV     D,L
0038'   1E 00                           MVI     E,0             ;CDE=theta3(k)*2<8
003A'   21 0000                         LXI     H,0
003D'   43                              MOV     B,E             ;BHL=0
003E'   CD 0000*                        CALL    ROT3R
0041'   CD 0000*                        CALL    ROT3R
0044'   CD 0000*                        CALL    ADD3
0047'   CD 0000*                        CALL    ROT3R
004A'   CD 0000*                        CALL    ADD3            ;BHL=a3*theta3(k)
004D'   3A 0003"                        LDA     T2K+1
0050'   4F                              MOV     C,A
0051'   3A 0002"                        LDA     T2K
0054'   57                              MOV     D,A
0055'   1E 00                           MVI     E,0             ;CDE=theta2(k)*2^8
0057'   CD 0000*                        CALL    ROT3R
005A'   CD 0000*                        CALL    ADD3
005D'   CD 0000*                        CALL    ROT3LV
0060'   CD 0000*                        CALL    ROT3LV
0063'   CD 0000*                        CALL    ADD3V           ;BHL=a3*theta3(k)+
                                                                ; +a2*theta2(k)
0066'   3A 0001*                        LDA     T1K+1
0069'   4F                              MOV     C,A
006A'   3A 0000*                        LDA     T1K
006D'   57                              MOV     D,A
006E'   1E 00                           MVI     E,0             ;CDE=theta1(k)*2^8
0070'   CD 0000*                        CALL    ROT3R
0073'   CD 0000*                        CALL    ROT3R
0076'   CD 0000*                        CALL    ADD3V
0079'   CD 0000*                        CALL    ROT3R
```

```
007C'  CD 0000*          CALL   ADD3V          ;BHL=a3*theta3(k)+
                                               ; +a2*theta2(k)+a'*theta1(k)
007F'  CD 0000*          CALL   CPL3
0082'  EB                XCHG
0083'  2A 0000*          LHLD   UK1
0086'  EB                XCHG
0087'  3A 0002*          LDA    UK1+2
008A'  4F                MOV    C,A            ;CDE=u(k-1)
008B'  CD 0000*          CALL   ADD3V  ;BHL=v(k-1).
008E'  EB                XCHG
008F'  48                MOV    C,B            ;CDE=v(k-1)
0090'  21 0000           LXI    H,0
0093'  06 00             MVI    B,0            ;BHL=0
0095'  CD 0000*          CALL   ROT3R
0098'  CD 0000*          CALL   ADD3V
009B'  CD 0000*          CALL   ROT3R
009E'  CD 0000*          CALL   ROT3R
00A1'  CD 0000*          CALL   ADD3V
00A4'  EB                XCHG
00A5'  2A 0000*          LHLD   VK2T
00A8'  EB                XCHG
00A9'  3A 0002*          LDA    VK2T+2
00AC'  4F                MOV    C,A            ;CDE=v~(k-2)
00AD'  CD 0000*          CALL   ROT3R
00B0'  CD 0000*          CALL   ROT3R
00B3'  CD 0000*          CALL   ADD3V
00B6'  CD 0000*          CALL   ROT3R
00B9'  CD 0000*          CALL   ADD3V  ;BHL=v~(k-2)
00BC'  22 0000*          SHLD   VK2T
00BF'  78                MOV    A,B
00C0'  32 0002*          STA    VK2T+2 ;v~(k-2) <- v~(k-1)
00C3'  2A 0000*          LHLD   TK
00C6'  EB                XCHG
00C7'  2A 0000*          LHLD   MK
00CA'  CD 0000*          CALL   COMP2          ;CY=1 data e(k)<0
00CD'  D2 00D1'          JNC    ARN4
00D0'  EB                XCHG
00D1'  F5          ARN4: PUSH   PSW
00D2'  CD 0000*          CALL   DIF2           ;DE=|e(k)|
00D5'  EB                XCHG
00D6'  06 00             MVI    B,0            ;BHL=|e(k)|
00D8'  F1                POP    PSW
00D9'  DC 0000*          CC     CPL3           ;BHL=e(k)
00DC'  EB                XCHG
00DD'  2A 0000*          LHLD   T1K
00E0'  EB                XCHG
00E1'  7A                MOV    A,D
00E2'  0E 00             MVI    C,0
00E4'  17                RAL
00E5'  D2 00EA'          JNC    ARN5
00E8'  0E FF             MVI    C,0FFH         ;CDE=theta'(k)
00EA'  CD 0000*    ARN5: CALL   ADD3V
00ED'  EB                XCHG
00EE'  2A 0002"          LHLD   T2K
00F1'  EB                XCHG
00F2'  7A                MOV    A,D
```

```
00F3'  0E 00                    MVI   C,0
00F5'  17                       RAL
00F6'  D2 00FB'                 JNC   ARN6
00F9'  0E FF                    MVI   C,0FFH          ;CDE=theta2(k)
00FB'  CD 0000*          ARN6:  CALL  ADD3V   ;BHL=s(k)
00FE'  78                       MOV   A,B
00FF'  17                       RAL                   ;CY=1 daca s(k) < 0
0100'  2A 0000"                 LHLD  K1
0103'  06 00                    MVI   B,0             ;BHL=K1
0105'   DC 0000*                CC    CPL3            ;BHL=K1*sign(s(k))
0108'  EB                       XCHG
0109'  2A 0002"                 LHLD  T2K
010C'  EB                       XCHG
010D'  7A                       MOV   A,D
010E'  0E 00                    MVI   C,0
0110'  17                       RAL
0111'  D2 0116'                 JNC   ARN7
0114'  0E FF                    MVI   C,0FFH          ;CDE=theta2(k)
0116'  CD 0000*          ARN7:  CALL  ADD3V
0119'  EB                       XCHG
011A'  2A 0004"                 LHLD  T3K
011D'  EB                       XCHG
011E'  7A                       MOV   A,D
011F'  0E 00                    MVI   C,0
0121'  17                       RAL
0122'  D2 0127'                 JNC   ARN8
0125'  0E FF                    MVI   C,0FFH          ;CDE=theta3(k)
0127'  CD 0000*          ARN8:  CALL  ADD3V
012A'  CD 0000*                 CALL  CPL3    ;BHL=theta1D(k)
012D'  22 0008"                 SHLD  T1DK
0130'  78                       MOV   A,B
0131'  32 000A"                 STA   T1DK+2
0134'  EB                       XCHG
0135'  2A 0000*                 LHLD  T1K
0138'  CD 0000*                 CALL  CPL2
013B'  EB                       XCHG                  ;DE=-theta1(k)
013C'  7A                       MOV   A,D
013D'  0E 00                    MVI   C,0
013F'  17                       RAL
0140'  D2 0145'                 JNC   ARN9
0143'  0E FF                    MVI   C,0FFH          ;CDE=-theta1(k)
0145'  CD 0000*          ARN9:  CALL  ADD3V   ;BHL=theta2D(k)
0148'  22 000B"                 SHLD  T2DK
014B'  78                       MOV   A,B
014C'  32 000D"                 STA   T2DK+2
014F'  EB                       XCHG
0150'  2A 0002"                 LHLD  T2K
0153'  CD 0000*                 CALL  CPL2
0156'  EB                       XCHG                  ;DE=theta2(k)
0157'  7A                       MOV   A,D
0158'  0E 00                    MVI   C,0
015A'  17                       RAL
015B'  D2 0160'                 JNC   ARN10
015E'  0E FF                    MVI   C,0FFH          ;CDE=theta2(k)
0160'  CD 0000*          ARN10: CALL  ADD3V   ;BHL=theta3D(k)
0163'  EB                       XCHG
```

```
0164'  48                        MOV   C,B          ;CDE=theta3D(k)
0165'  21 0000                   LXI   H,0
0168'  06 00                     MVI   B,0          ;BHL=0
016A'  CD 0000*                  CALL  ROT3R
016D'  CD 0000*                  CALL  ROT3R
0170'  CD 0000*                  CALL  ALD3V
0173'  CD 0000*                  CALL  ROT3R
0176'  CD 0000*                  CALL  ADD3V        ;BHL=a3*theta3D(k)
0179'  EB                        XCHG
017A'  2A 000B"                  LHLD  T2DK
017D'  EB                        XCHG
017E'  3A 000D"                  LDA   T2DK+2
0181'  4F                        MOV   C,A          ;CDE=theta2D(k)
0182'  CD 0000*                  CALL  ROT3R
0185'  CD 0000*                  CALL  ADD3V
0188'  CD 0000*                  CALL  ROT3LV
018B'  CD 0000*                  CALL  ROT3LV
018E'  CD 0000*                  CALL  ADD3V        ;BHL=a3*theta3D(k)+
                                                    ; +a2*theta2D(k)
0191'  EB                        XCHG
0192'  2A 0008"                  LHLD  T1DK
0195'  EB                        XCHG
0196'  3A 000A"                  LDA   T1DK+2
0199'  4F                        MOV   C,A
019A'  CD 0000*                  CALL  ROT3R        ;CDE=theta1D(k)
019D'  CD 0000*                  CALL  ADD3V
01A0'  CD 0000*                  CALL  ROT3R
01A3'  CD 0000*                  CALL  ROT3R
01A6'  CD 0000*                  CALL  ADD3V
01A9'  CD 0000*                  CALL  ROT3R
01AC'  CD 0000*                  CALL  ADD3V        ;BHL=a3*theta3D(k)+
                                                    ; +a2*theta2D(k)+a1*theta1D(
01AF'  EB                        XCHG
01B0'  2A 0000*                  LHLD  VK2T
01B3'  EB                        XCHG
01B4'  3A 0002*                  LDA   VK2T+2
01B7'  4F                        MOV   C,A          ;CDE=v~(k-2)
01B8'  CD 0000*                  CALL  ADD3V   ;BHL=u(k)
01BB'  22 0000*                  SHLD  UK1
01BE'  78                        MOV   A,B
01BF'  32 0002*                  STA   UK1+2        ;u(k-1) <- u(k)
01C2'  17                        RAL
01C3'  AF                        XRA   A
01C4'  CE 00                     ACI   0            ;A=1 daca u(k) < 0
01C6'  32 0000*                  STA   US
01C9'  78                        MOV   A,B
01CA'  17                        RAL
01CB'  DC 0000*                  CC    CPL3         ;BHL=!u(k)!
01CE'  78                        MOV   A,B
01CF'  B7                        ORA   A
01D0'  CA 01D6'                  JZ    ARN11
01D3'  21 0FFF                   LXI   H,0FFFH      ;limitare !u(k)!
01D6'  22 0000*            ARN11: SHLD  UK
01D9'  C9                        RET
                                 END
```

Macros:

Symbols:

005B*	ADD3	01B9*	[illegible]	000[illegible]	[illegible]
0160'	ARN[illegible]0	0[illegible]D6'	[illegible]	00[illegible]'	[illegible]
00EA'	ARN5	00F[illegible]'	ARN6	0[illegible]5'	[illegible]
0127'	ARN8	0145'	ARN9	00[illegible]*	[illegible]
0154*	CPL2	0100*	CPL3	0[illegible]*	[illegible]
0000I"	K1	0000*	[illegible]	000[illegible]*	[illegible]
018C*	ROT3LV	01AA*	ROT3R	000[illegible]"	[illegible]
0136*	T1K	00[illegible]*	T1K1	00[illegible]"	[illegible]
0002"	T2K	000[illegible]"	T2[illegible]	0004"	[illegible]
00C4*	TK	000F*	TK1	[illegible]*	[illegible]
01C0*	UK1	0107*	US	[illegible]*	[illegible]
00C8*	WK				

No Fatal error(s)

```
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                        ;
                        ;subrutine matematice
                        ;
                                PUBLIC  MUL12,CPL3,MUL12M,CPL2,ADD3V,ADD3
                                PUBLIC  ROT3R,DIF2,COMP2,ROT3LV
                        ;
0000'                           CSEG
                        ;
                        ;MUL12  inmultire 1o(M) * 2o(C2) -> 3o(C2)
                        ;               C * DE -> BHL
                        ;       modific  A,F
                        ;
0000'   7A              MUL12:  MOV     A,D
0001'   17                      RAL
0002'   F5                      PUSH    PSW
0003'   D2 000B'                JNC     MODUL
0006'   EB                      XCHG
0007'   CD 0038'                CALL    CPL2
000A'   EB                      XCHG
000B'   41              MODUL:  MOV     B,C
000C'   0E 08                   MVI     C,8     ;conto
000E'   21 0000                 LXI     H,0
0011'   29              LOOP:   DAD     H       ;rotire stinga BHL
0012'   78                      MOV     A,B
0013'   17                      RAL
0014'   47                      MOV     B,A
0015'   D2 001D'                JNC     NEXT
0018'   19                      DAD     D
0019'   D2 001D'                JNC     NEXT
001C'   04                      INR     B
001D'   0D              NEXT:   DCR     C
001E'   C2 0011'                JNZ     LOOP
0021'   F1                      POP     PSW
0022'   D0                      RNC             ;subrutina continua cu CPL3
                        ;
                        ;CPL3   complementare 3o
                        ;                       BHL <- -(BHL)
                        ;       modifica A,F,D,E
0023'   7D              CPL3:   MOV     A,L
0024'   2F                      CMA
0025'   6F                      MOV     L,A
0026'   7C                      MOV     A,H
0027'   2F                      CMA
0028'   67                      MOV     H,A
0029'   78                      MOV     A,B
002A'   2F                      CMA
002B'   11 0001                 LXI     D,1
002E'   19                      DAD     D
002F'   CE 00                   ACI     0
0031'   47                      MOV     B,A
0032'   C9                      RET
                        ;
                        ;MUL12M inmultire 1o(M) * 2o(M) -> 3o(M)
                        ;               C * DE -> BHL
                        ;       modifica A,F
0033'   B7              MUL12M: ORA     A       ;CY=0
```

```
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0034'  F5                              PUSH    PSW
0035'  C3 000B'                        JMP     MODUL   ;subrutina continua in MUL12
                                ;
                                ;CPL2   complementare 2o
                                ;                       HL <- -(HL)
                                ;       NU modifica B,C,D,E
0038'  7C                       CPL2:   MOV     A,H
0039'  2F                               CMA
003A'  67                               MOV     H,A
003B'  7D                               MOV     A,L
003C'  2F                               CMA
003D'  6F                               MOV     L,A
003E'  23                               INX     H
003F'  C9                               RET
                                ;
                                ;ADD3V  adunare 3o(C2) + 3o(C2) -> 3o(C2)
                                ;       cu verificarea depasirii si limitare
                                ;               BHL + CDE -> BHL
                                ;       modifica A,F
                                ;       pastreaza CDE
0040'  78                       ADD3V:  MOV     A,B
0041'  A9                               XRA     C
0042'  17                               RAL             ;CY=B7(+)C7
0043'  DA 0062'                         JC      SUM1
0046'  CD 0066'                         CALL    ADD3
0049'  78                               MOV     A,B
004A'  D2 004F'                         JNC     SUM2
004D'  C6 80                            ADI     80H     ;CY= OVF=B7(+)CY
004F'  17                       SUM2:   RAL
0050'  D0                               RNC             ;rezultat corect in BHL
0051'  79                               MOV     A,C
0052'  17                               RAL             ;CY=sgn{CDE{
0053'  DA 005C'                         JC      SUM3
0056'  21 FFFF                          LXI     H,0FFFFH        ;limitare superioara
0059'  06 7F                            MVI     B,7FH
005B'  C9                               RET
005C'  21 0000                  SUM3:   LXI     H,0             ;limitare inferioara
005F'  06 80                            MVI     B,80H
0061'  C9                               RET
0062'  CD 0066'                 SUM1:   CALL    ADD3    ;nu poate aparea depasire
0065'  C9                               RET
                                ;
                                ;ADD3   adunare 3o + 3c = 3o
                                ;               BHL + CDE -> BHL
                                ;       modifica A,F
                                ;       pastreaza CDE
0066'  19                       ADD3:   DAD     D
0067'  78                               MOV     A,B
0068'  89                               ADC     C
0069'  47                               MOV     B,A
006A'  C9                               RET
                                ;
                                ;ROT3R  rotire dreapta 3o(C2)
                                ;                       CDE/2 -> CDE
                                ;       NU distruge BHL
006B'  AF                       ROT3R:  XRA     A       ;CY=0
```

```
006C' 79                        MOV     A,C
006D' 17                        RAL
006E' 79                        MOV     A,C
006F' 1F                        RAR
0070' 4F                        MOV     C,A
0071' 7A                        MOV     A,D
0072' 1F                        RAR
0073' 57                        MOV     D,A
0074' 7B                        MOV     A,E
0075' 1F                        RAR
0076' 5F                        MOV     E,A
0077' C9                        RET
                        ;
                        ;DIF2   scadere 2o
                        ;               DE - HL -> DE
                        ;       NU distruge B,C
0078' CD 0038'          DIF2:   CALL    CPL2
007B' 19                        DAD     D
007C' EB                        XCHG
007D' C9                        RET
                        ;
                        ;COMP2  comparare 2o
                        ;       CY=1 daca DE < HL
                        ;       modifica A,F
007E' 7A                COMP2:  MOV     A,D
007F' BC                        CMP     H
0080' C0                        RNZ
0081' 7B                        MOV     A,E
0082' BD                        CMP     L
0083' C9                        RET
                        ;
                        ;ROT3LV rotire stinga 3o(C2)
                        ;       cu verificarea depasirii si limitare
                        ;       2 * CDE -> CDE
0084' 79                ROT3LV: MOV     A,C
0085' E6 C0                     ANI     0C0H    ;1100 0000 B
0087' E2 0091'                  JPO     DEP
008A' EB                        XCHG
008B' 29                        DAD     H
008C' EB                        XCHG
008D' 79                        MOV     A,C
008E' 17                        RAL
008F' 4F                        MOV     C,A
0090' C9                        RET
0091' 17                DEP:    RAL             ;CY=1 daca CDE<0
0092' DA 009B'                  JC      DEPINF
0095' 11 FFFF                   LXI     D,0FFFFH
0098' 0E 7F                     MVI     C,7FH   ;depasire superioara
009A' C9                        RET
009B' 11 0000           DEPINF:LXI      D,0
009E' 0E 80                     MVI     C,80H   ;depasire inferioara
00A0' C9                        RET
                                END
```

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Macros:

Symbols:

0066I'	ADD3	0040I'	ADD3V	007EI'	COMP2
0038I'	CPL2	0023I'	CPL3	0091'	DEP
009B'	DEPINF	0078I'	DIF2	0011'	LOOP
000B'	MODUL	0000I'	MUL12	0033I'	MUL12M
001D'	NEXT	0084I'	ROT3LV	006BI'	ROT3R
0062'	SUM1	004F'	SUM2	005C'	SUM3

No Fatal error(s)

ANEXA A8

PROGRAMUL DE IMPLEMENTARE CONCRETA A PROCEDURII DE UTILIZARE A ALGORITMILOR DE REGLARE NUMERICA IN MOD COMBINAT

1. Algoritm de reglare numeric, clasic PI
2. Combinatia algoritmelor ARMA-1 si ARMA-PI
3. Combinatia algoritmelor ARMA-2 si ARMA-PI

```
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                                NAME    ('ARMPI')
                        ;
                        ;algoritm de reglare PI
                        ;-----------------------
                        ;
                                PUBLIC  ARMPI
                                EXT     TK,WK,UK,US
                                EXT     TK1,T1K,T1K1,UK1
                                EXT     MUL12,CPL3,MUL12I,CPL2,ADD3V,ADD3
                                EXT     ROT3R,DIV2,COMP2,ROT3LV
                        ;
0000'                           DSEG
0000"                   WK1:    DS      2
                        ;
0002"                           CSEG
0000'  2A 0000*         ARMPI:  LHLD    TK
0003'  EB                       XCHG
0004'  0E 00                    MVI     C,0
0006'  2A 0000*                 LHLD    TK1
0009'  06 00                    MVI     B,0
000B'  D5                       PUSH    D
000C'  CD 0000*                 CALL    CPL3
000F'  D1                       POP     D
0010'  CD 0000*                 CALL    ADD3
0013'  22 0000*                 SHLD    T1K     ;DE=theta1(k)=theta(k)-
                                                ; -theta(k-1)
                        ;
0016'  E5                       PUSH    H
0017'  44                       MOV     B,H
0018'  65                       MOV     H,L
0019'  2E 00                    MVI     L,0     ;BHL=256*theta1(k)
001B'  48                       MOV     C,B
001C'  54                       MOV     D,H
001D'  5D                       MOV     E,L
001E'  CD 0000*                 CALL    ROT3R   ;CDE=128*theta1(k)
0021'  CD 0000*                 CALL    ADD3    ;BHL=(256+128)*theta1(k)
0024'  E3                       XTHL            ;HL=theta1(k)
0025'  C5                       PUSH    B
0026'  EB                       XCHG
0027'  0E 11                    MVI     C,17
0029'  CD 0000*                 CALL    MUL12   ;BHL=17*theta1(k)
002C'  D1                       POP     D
002D'  4A                       MOV     C,D
002E'  D1                       POP     D
002F'  CD 0000*                 CALL    ADD3
0032'  CD 0000*                 CALL    CPL3    ;BHL=-401*theta1(k)
                        ;
0035'  EB                       XCHG
0036'  2A 0000*                 LHLD    T1K1
0039'  EB                       XCHG
003A'  D5                       PUSH    D
003B'  4A                       MOV     C,D
003C'  53                       MOV     D,E
003D'  1E 00                    MVI     E,0     ;CDE=256*theta1(k-1)
003F'  CD 0000*                 CALL    ADD3V
0042'  E3                       XTHL
```

```
        MACRO-80 3.44   09-Dec-81       PAGE    1-1

                                2
0043'   C5                              PUSH    B
0044'   EB                              XCHG
0045'   0E 5E                           MVI     C,94
0047'   CD 0000*                        CALL    MUL12   ;BHL=94*theta1(k-1)
004A'   D1                              POP     D
004B'   4A                              MOV     C,D
004C'   D1                              POP     D
004D'   CD 0000*                        CALL    ADD3V   ;BHL=-401*theta1(k)+
                                                        ; +350*theta1(k-1)
                                ;
0050'   E5                              PUSH    H
0051'   C5                              PUSH    B
0052'   2A 0000*                        LHLD    WK
0055'   EB                              XCHG
0056'   0E 1A                           MVI     C,26
0058'   CD 0000*                        CALL    MUL12M  ;BHL=26*w(k)
005B'   D1                              POP     D
005C'   4A                              MOV     C,D
005D'   D1                              POP     D
005E'   CD 0000*                        CALL    ADD3V   ;BHL=-401*theta1(k)+
                                                        ; +350*theta1(k-1)+26*w(k)
                                ;
0061'   E5                              PUSH    H
0062'   C5                              PUSH    B
0063'   2A 0000"                        LHLD    WK1
0066'   EB                              XCHG
0067'   0E 18                           MVI     C,24
0069'   CD 0000*                        CALL    MUL12M  ;BHL=24*w(k-1)
006C'   CD 0000*                        CALL    CPL3    ;BHL=-24*w(k-1)
006F'   D1                              POP     D
0070'   4A                              MOV     C,D
0071'   D1                              POP     D
0072'   CD 0000*                        CALL    ADD3V   ;BHL=-401*theta1(k)+
                                                        ; +350*theta1(k-1)+26*w(k)-
                                                        ; -24*w(k-1)
0075'   E5                              PUSH    H
0076'   C5                              PUSH    B
0077'   2A 0000*                        LHLD    TK1
007A'   EB                              XCHG
007B'   0E 02                           MVI     C,2
007D'   CD 0000*                        CALL    MUL12M  ;BHL=2*theta(k-1)
0080'   CD 0000*                        CALL    CPL3    ;BHL=-2*theta(k-1)
0083'   D1                              POP     D
0084'   4A                              MOV     C,D
0085'   D1                              POP     D
0086'   CD 0000*                        CALL    ADD3V   ;BHL=-401*theta1(k)+
                                                        ; +350*theta1(k-1)+26*w(k)-
                                                        ; -24*w(k-1)-2*theta(k-1)
0089'   E5                              PUSH    H
008A'   C5                              PUSH    B       ;suma -> stiva
008B'   2A 0000*                        LHLD    UK
008E'   06 00                           MVI     B,0     ;BHL=!u(k)!
0090'   3A 0000*                        LDA     US
0093'   B7                              ORA     A
0094'   C4 0000*                        CNZ     CPL3    ;BHL=u(k)
0097'   D1                              POP     D
```

```
                                3
0098'   4A                              MOV     C,D
0099'   D1                              POP     D       ;CDE=suma
009A'   CD 0000*                        CALL    ADD3V   ;BHL=-401*theta1(k)+
                                                        ; +350*theta1(k-1)+26*w(k)-
                                                        ; -24*w(k-1)-2*theta(k-1)+
                                                        ; +u(k-1)=u(k)
009D'   22 0000*                        SHLD    UK1
00A0'   78                              MOV     A,B
00A1'   32 0002*                        STA     UK1+2   ;u(k-1) <- u(k)
                                ;
00A4'   17                              RAL
00A5'   3E 00                           MVI     A,0
00A7'   17                              RAL
00A8'   32 0000*                        STA     US      ;semn
00AB'   1F                              RAR
00AC'   DC 0000*                        CC      CPL3    ;BHL=!u(k)!
00AF'   78                              MOV     A,B
00B0'   B7                              ORA     A
00B1'   CA 00B7'                        JZ      ARP1
00B4'   21 FFFF                         LXI     H,0FFFFH        ;limitare
00B7'   22 0000*                ARP1:   SHLD    UK
                                ;
00BA'   2A 0000*                        LHLD    WK
00BD'   22 0000"                        SHLD    WK1     ;w(k-1) <- w(k)
00C0'   2A 0000*                        LHLD    TK
00C3'   22 0000*                        SHLD    TK1     ;theta(k-1) <- theta(k)
00C6'   2A 0000*                        LHLD    T1K
00C9'   22 0000*                        SHLD    T1K1    ;theta1(k-1) <- theta1(k)
00CC'   C9                              RET
                                        END
```

Macros:

Symbols:

0030*	ADD3	009B*	ADD3V	0000I'	ARMPI
00B7'	ARP1	0000*	COMP2	0000*	CPL2
00AD*	CPL3	0000*	DIF2	0048*	MUL12
007E*	MUL12M	0000*	ROT3LV	001F*	ROT3R
00C7*	T1K	00CA*	T1K1	00C1*	TK
00C4*	TK1	00B8*	UK	00A2*	UK1
00A9*	US	00BB*	VK	0000"	VK1

No Fatal error(s)

```
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                                        NAME    ('ARNC1')
                                ;
                                ;algoritm combinat ARMA1 + ARN-PI
                                ;---- ---------- ---------- -- -
                                ;
                                        PUBLIC  ARNC1,PRAG
                                        EXT     ARMA1,ARNPI
                                        EXT     TK,WK,UK,US
                                        EXT     TK1,UK1,VK2T,T1K1,T2K1,WK1
                                        EXT     MUL12,CPL3,MUL12M,CPL2,ADD3V,ADD3
                                        EXT     ROT3R,DIF2,COMP2,ROT3LV
                                ;variabile
0000'                                   DSEG
0000"                           FLAG:   DS      1       ;fanion comutare
                                                        ; (0:ARMA; 1:ARNPI)
                                ;parametri
0001"   00C8                   PRAG:   DW      200
                                ;program
0003"                                   CSEG
0000'   2A 0000*                ARNC1: LHLD    TK
0003'   EB                              XCHG
0004'   2A 0000*                       LHLD    WK
0007'   CD 0000*                       CALL    COMP2
000A'   D2 000E'                       JNC     ARN13
000D'   EB                              XCHG
000E'   CD 0000*                ARN13: CALL    DIF2            ;DE=!e(k)!
0011'   2A 0001"                       LHLD    PRAG
0014'   CD 0000*                       CALL    COMP2           ;CY=1 daca !e(k)! < PRAG
0017'   3A 0000"                       LDA     FLAG
001A'   17                              RAL                     ;A=00 sau 01 daca se
                                                                ;pastreaza tipul alg.
                                                                ;A=10 sau 01 daca se
                                                                ;schimba tipul alg.
001B'   C6 00                           ADI     0               ;pozitioneaza fanionul P
001D'   E2 0027'                        JPO     CHANGE
0020'   1F                              RAR                     ;CY=1 pentru ARNP
0021'   DA 0000*                       JC      ARNPI
0024'   C3 0000*                       JMP     ARMA1
0027'   1F                      CHANGE: RAR
0028'   2F                              CMA
0029'   E6 01                           ANI     1
002B'   32 0000"                       STA     FLAG
002E'   C2 0041'                       JNZ     CHPI
0031'   21 0000                        LXI     H,0             ;comutare ARNPI -> ARMA-
0034'   22 0000*                       SHLD    T1K1
0037'   22 0000*                       SHLD    VK2T
003A'   7C                              MOV     A,H
003B'   32 0002*                       STA     VK2T+2
003E'   C3 0000*                       JMP     ARMA1
0041'   2A 0000*                CHPI:  LHLD    WK              ;comutare ARMA-1 -> ARNP
0044'   22 0000*                       SHLD    WK1
0047'   C3 0000*                       JMP     ARNPI
                                        END
```

Macros:

Symbols:

0000*	ADD3	0000*	ADD3V	003F*	ARM1
000E'	ARM13	0000I'	ARMC1	0048*	ARMP1
0027'	CHANGE	0041'	CHP1	0015*	COMP2
0000*	CPL2	0000*	CPL3	000F*	DIF2
0000"	FLAG	0000*	MUL12	0000*	MUL12M
0001I"	PRAG	0000*	ROT3LV	0000*	ROT3R
0035*	T1K1	0000*	T2K1	0001*	TK
0000*	TK1	0000*	UK	0000*	UK1
0000*	US	003C*	VK2T	0042*	WK
0045*	WK1				

No Fatal error(s)

```
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                              NAME     ('ARNC2')
                        ;
                        ;algoritm combinat ARMA2 + ARN-PI
                        ;------------------------------------------
                        ;
                              PUBLIC   ARNC2
                              EXT      PRAG
                              EXT      ARMA2,ARNPI
                              EXT      TK,WK,UK,US
                              EXT      TK1,UK1,VK2T,T1K1,T2K1,WK1
                              EXT      MUL12,CPL3,MUL12M,CPL2,ADD3V,ADD3
                              EXT      ROT3R,DIF2,COMP2,ROT3LV
                        ;variabile
0000'                         DSEG
0000"                   FLAG: DS       1        ;fanion comutare
                                                ;(0:ARMA; 1:ARNPI)
                        ;program
0001"                         CSEG
0000'   2A 0000*        ARNC2: LHLD    TK
0003'   EB                    XCHG
0004'   2A 0000*              LHLD     WK
0007'   CD 0000*              CALL     COMP2
000A'   D2 000E'              JNC      ARN23
000D'   EB                    XCHG
000E'   CD 0000*        ARN23: CALL    DIF2            ;DE=!e(k)!
0011'   2A 0000*              LHLD     PRAG
0014'   CD 0000*              CALL     COMP2           ;CY=1 daca !e(k)! < PRAG
0017'   3A 0000"              LDA      FLAG
001A'   17                    RAL                      ;A=00 sau 11 daca se
                                                       ;pastreaza tipul alg.
                                                       ;A=10 sau 01 daca se
                                                       ;schimba tipul alg.
001B'   C6 00                 ADI      0               ;pozitioneaza fanionul P
001D'   E2 0027'              JPO      CHANG2
0020'   1F                    RAR                      ;CY=1 pentru ARNPI
0021'   DA 0000*              JC       ARNPI
0024'   C3 0000*              JMP      ARMA2
0027'   1F              CHANG2: RAR
0028'   2F                    CMA
0029'   E6 01                 ANI      1
002B'   32 0000"              STA      FLAG
002E'   C2 0044'              JNZ      CHPI2
0031'   21 0000               LXI      H,0             ;comutare ARNPI -> ARMA-2
0034'   22 0000*              SHLD     T1K1
0037'   22 0000*              SHLD     T2K1
003A'   22 0000*              SHLD     VK2T
003D'   7C                    MOV      A,H
003E'   32 0002*              STA      VK2T+2
0041'   C3 0000*              JMP      ARMA2
0044'   2A 0000*        CHPI2: LHLD    WK              ;comutare ARMA-2 -> ARNPI
0047'   22 0000*              SHLD     WK1
004A'   C3 0000*              JMP      ARNPI
                              END
```

Macros:

Symbols:

0000*	ADD3	0000*	ADD3V	0042*	ARMA2
000E'	ARN23	0000I'	ARNC2	004B*	ARNPI
0027'	CHANG2	0044'	CHPI2	0015*	COMP2
0000*	CPL2	0000*	CPL3	000F*	DIF2
0000"	FLAG	0000*	MUL12	0000*	MUL12M
0012*	PRAG	0000*	ROT3LV	0000*	ROT3R
0035*	T1K1	0038*	T2K1	0001*	TK
0000*	TK1	0000*	UK	0000*	UK1
0000*	US	003F*	VK2T	0045*	WK
0048*	WK1				

No Fatal error(s)

ANEXA A9

PROGRAMUL TEST
DE IMPLEMENTARE SI TESTARE PE MODEL EXPERIMENTAL
A ALGORITMILOR DE REGLARE NUMERICA CLASICE
SI MODAL ALUNECATOARE

1. Algoritm de reglare numeric, clasic PI
2. Combinatia algoritmelor ARMA-1 si ARM-PI
3. Combinatia algoritmelor ARMA-2 si ARM-PI

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```
                        ;
                        ;programul de testare
                        ;--------------------
                        ;
                                PUBLIC  TEST,ARNT,ARNC
                                EXT     ETR,ARMA1,ARMA2,ARNPI,ARNC1,ARNC2
                                EXT     K1,K2,K3,K4,PRAG
                                EXT     TK,WK,UK,US,START,T1K,COMP2
                                EXT     CPL2,DIF2
                        ;rutinele de monitor
4429                    IN8     EQU     4429H   ;DAF -> B(ASCII)
4437                    OUT8Q   EQU     4437H   ;A(ASCII) -> DAF
4534                    ADEC    EQU     4534H   ;conversie sir cifre
                                                ;zecimale(ASCII) -> HL(hexa)
4441                    CRLF    EQU     4441H   ;<CR>,<LF> -> DAF
4584                    DOUT    EQU     4584H   ;A(hexa) -> DAF(zecimal)
45CC                    BIN1    EQU     45CCH   ;A low (hexa) -> A(ASCII)
                        ;date
0000'                           DSEG
0000"                   TABW:   DS      400H    ;tabel w
0400"                   TABUP:  DS      400H    ;tabel up
0800"                   TABT:   DS      400H    ;tabel theta
0C00"                   TABO:   DS      400H    ;tabel omega
1000"                   TABU:   DS      400H    ;tabel u
                        ;
1400" 0000*             TABCON: DW      ARMA1   ;tabel adrese subr.ARN
1402" 0000*                     DW      ARMA2
1404" 0000*                     DW      ARNPI
1406" 0000*                     DW      ARNC1
1408" 0000*                     DW      ARNC2
140A"                           DS      8       ;pentru extinderi ulterioare
                        ;
1412"                   ADNR:   DS      5       ;buffer caractere receptionate
1417"                   MEM1:   DS      2
1419"                   MEM2:   DS      2
141B"                   MEM3:   DS      2
141D"                   MEM4:   DS      2
141F"                   MEM5:   DS      2       ;locatii temporare
1421"                   ACON:   DS      3       ;conversie hexa -> zecimal
1424"                   SOYM:   DS      1
1425"                   SOYN:   DS      1
1426"                   GRAFK:  DS      1       ;variabile pentru GRAF
1427"                   MOD:    DS      1       ;mod rulare
1428"                   SENSP:  DS      1       ;sens perturbatie
1429"                   K5:     DS      1       ;tip ARN
142A"                   STAB:   DS      1       ;pointer tabele
                                PAGE
```

```
                        ;.
                        ;mesaje
1423"  52 45 47 49      M1:     DB      'REGIM DE RULARE',0DH
142F"  4D 20 44 45
1433"  20 52 55 4C
1437"  41 52 45 0D
143B"  20 20 20 20              DB      '    A: ACORDARE ALGORITMI',0DH
143F"  41 3A 20 41
1443"  43 4F 52 44
1447"  41 52 45 20
144B"  41 4C 47 4F
144F"  52 49 54 4D
1453"  49 0D
1455"  20 20 20 20              DB      '    D: EXECUTIE CU PRESCRIERE DE LA '
1459"  44 3A 20 45
145D"  58 45 43 55
1461"  54 49 45 20
1465"  43 55 20 50
1469"  52 45 53 43
146D"  52 49 45 52
1471"  45 20 44 45
1475"  20 4C 41 20
1479"  44 41 46 0D
147D"  20 20 20 20              DB      '    T: EXECUTIE IN REGIM DE TESTARE'
1481"  54 3A 20 45
1485"  58 45 43 55
1489"  54 49 45 20
148D"  49 4E 20 52
1491"  45 47 49 4D
1495"  20 44 45 20
1499"  54 45 53 54
149D"  41 52 45 0D
14A1"  20 20 20 20              DB      '    Q: TERMINARE PROGRAM;'
14A5"  51 3A 20 54
14A9"  45 52 4D 49
14AD"  4E 41 52 45
14B1"  20 50 52 4F
14B5"  47 52 41 4D
14B9"  3B
14BA"  4F 50 45 52      M2:     DB      'OPERATII PENTRU TESTARE',0DH
14BE"  41 54 49 49
14C2"  20 50 45 4E
14C6"  54 52 55 20
14CA"  54 45 53 54
14CE"  41 52 45 0D
14D2"  20 20 20 20              DB      '    G: GENERARE TABELE',0DH
14D6"  47 3A 20 47
14DA"  45 4E 45 52
14DE"  41 52 45 20
14E2"  54 41 42 45
14E6"  4C 45 0D
14E9"  20 20 20 20              DB      '    E: EXECUTIE ALGORITMI',0DH
14ED"  45 3A 20 45
14F1"  58 45 43 55
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14F5"  54 49 45 20
14F9"  41 4C 47 4F
14FD"  52 49 54 4D
1501"  49 0D
1503"  20 20 20 20                DB      '    A: AFISARE TABELE',0DH
1507"  41 3A 20 41
150B"  46 49 53 41
150F"  52 45 20 54
1513"  41 42 45 4C
1517"  45 0D
1519"  20 20 20 20                DB      '    Q: IESIRE DIN MENIU;'
151D"  51 3A 20 49
1521"  45 53 49 52
1525"  45 20 44 49
1529"  4E 20 4D 45
152D"  4E 49 55 3B
1531"  47 45 4E 45          M3:   DB      'GENERARE TABELE',0DH
1535"  52 41 52 45
1539"  20 54 41 42
153D"  45 4C 45 0D
1541"  20 20 20 20                DB      '    W: REFERINTA POZITIE',0DH
1545"  57 3A 20 52
1549"  45 46 45 52
154D"  49 4E 54 41
1551"  20 50 4F 5A
1555"  49 54 49 45
1559"  0D
155A"  20 20 20 20                DB      '    P: PERTURBATIE',0DH
155E"  50 3A 20 50
1562"  45 52 54 55
1566"  52 42 41 54
156A"  49 45 0D
156D"  20 20 20 20                DB      '    Q: IESIRE DIN MENIU;'
1571"  51 3A 20 49
1575"  45 53 49 52
1579"  45 20 44 49
157D"  4E 20 4D 45
1581"  4E 49 55 3B
1585"  41 46 49 53          M4:   DB      'AFISARE TABELE',0DH
1589"  41 52 45 20
158D"  54 41 42 45
1591"  4C 45 0D
1594"  20 20 20 20                DB      '    W: REFERINTA POZITIE',0DH
1598"  57 3A 20 52
159C"  45 46 45 52
15A0"  49 4E 54 41
15A4"  20 50 4F 5A
15A8"  49 54 49 45
15AC"  0D
15AD"  20 20 20 20                DB      '    P: PERTURBATIE',0DH
15B1"  50 3A 20 50
15B5"  45 52 54 55
15B9"  52 42 41 54
15BD"  49 45 0D
15C0"  20 20 20 20                DB      '    T: POZITIE',0DH
15C4"  54 3A 20 50
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15C8"   4F 5A 49 54
15CC"   49 45 0D
15CF"   20 20 20 20                 DB      '    O: VITEZA',0DH
15D3"   4F 3A 20 56
15D7"   49 54 45 5A
15DB"   41 0D
15DD"   20 20 20 20                 DB      '    U: COMANDA',0DH
15E1"   55 3A 20 43
15E5"   4F 4D 41 4E
15E9"   44 41 0D
15EC"   20 20 20 20                 DB      '    Q: IESIRE DIN MENIU;'
15F0"   51 3A 20 49
15F4"   45 53 49 52
15F8"   45 20 44 49
15FC"   4E 20 4D 45
1600"   4E 49 55 3B
1604"   50 45 52 54         M5:     DB      'PERTURBATIE',0DH
1608"   55 52 42 41
160C"   54 49 45 0D
1610"   20 20 20 20                 DB      '    P: IN SENS POZITIV',0DH
1614"   50 3A 20 49
1618"   4E 20 53 45
161C"   4E 53 20 50
1620"   4F 5A 49 54
1624"   49 56 0D
1627"   20 20 20 20                 DB      '    N: IN SENS NEGATIV',0DH
162B"   4E 3A 20 49
162F"   4E 20 53 45
1633"   4E 53 20 4E
1637"   45 47 41 54
163B"   49 56 0D
163E"   20 20 20 20                 DB      '    A: IN ANBELE SENSURI;'
1642"   41 3A 20 49
1646"   4E 20 41 4D
164A"   42 45 4C 45
164E"   20 53 45 4E
1652"   53 55 52 49
1656"   3B
1657"   4B 31 3D 3B         M6:     DB      'K1=;'
165B"   4B 32 3D 3B         M7:     DB      'K2=;'
165F"   4B 33 3D 3B         M8:     DB      'K3=;'
1663"   4B 34 3D 3B         M9:     DB      'K4=;'
1667"   4B 35 3D 3B         M10:    DB      'K5=;'
166B"   46 4F 52 4D         M11:    DB      'FORMA:',0DH
166F"   41 3A 0D
1672"   20 20 20 20                 DB      '    C: CONSTANTA',0DH
1676"   43 3A 20 43
167A"   4F 4E 53 54
167E"   41 4E 54 41
1682"   0D
1683"   20 20 20 20                 DB      '    T: TREAPTA',0DH
1687"   54 3A 20 54
168B"   52 45 41 50
168F"   54 41 0D
1692"   20 20 20 20                 DB      '    R: RAMPA;'
1696"   52 3A 20 52
```

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169A"  41 4D 50 41
169E"  3B
169F"  56 41 4C 4F          M12:   DB     'VALOAREA=;'
16A3"  41 52 45 41
16A7"  3D 3B
16A9"  4E 52 2E 20          M13:   DB     'NR. CUANTEI IN CARE INCEPE TREAPTA =
16AD"  43 55 41 4E
16B1"  54 45 49 20
16B5"  49 4E 20 43
16B9"  41 52 45 20
16BD"  49 4E 43 45
16C1"  50 45 20 54
16C5"  52 45 41 50
16C9"  54 41 20 3D
16CD"  3B
16CE"  4E 52 2E 20          M14:   DB     'NR. CUANTEI IN CARE INCEPE RAMPA =;'
16D2"  43 55 41 4E
16D6"  54 45 49 20
16DA"  49 4E 20 43
16DE"  41 52 45 20
16E2"  49 4E 43 45
16E6"  50 45 20 52
16EA"  41 4D 50 41
16EE"  20 3D 3B
16F1"  56 41 4C 4F          M15:   DB     'VALOAREA INITIALA =;'
16F5"  41 52 45 41
16F9"  20 49 4E 49
16FD"  54 49 41 4C
1701"  41 20 3D 3B
1705"  56 41 4C 4F          M16:   DB     'VALOAREA FINALA =;'
1709"  41 52 45 41
170D"  20 46 49 4E
1711"  41 4C 41 20
1715"  3D 3B
1717"  50 41 4E 54          M17:   DB     'PANTA RAMPEI =;'
171B"  41 20 52 41
171F"  4D 50 45 49
1723"  20 3D 3B
1726"  4E 52 2E 20          M18:   DB     'NR. INTERVALE PE OY = 2**N',ODH
172A"  49 4E 54 45
172E"  52 56 41 4C
1732"  45 20 50 45
1736"  20 4F 59 20
173A"  3D 20 32 2A
173E"  2A 4E 0D
1741"  20 20 20 20                  DB     '    N =;'
1745"  4E 20 3D 3B
1749"  41 46 49 53          M19:   DB     'AFISARE INTERVAL N',ODH
174D"  41 52 45 20
1751"  49 4E 54 45
1755"  52 56 41 4C
1759"  20 4D 0D
175C"  20 20 20 20                  DB     '    N =;'
1760"  4D 20 3D 3B
1764"  41 46 49 53          M20:   DB     'AFISARE TABEL DIN K IN K VALORI',ODH
1768"  41 52 45 20
```

```
176C"  54 41 42 45
1770"  4C 20 44 49
1774"  4E 20 4B 20
1778"  49 4E 20 4B
177C"  20 56 41 4C
1780"  4F 52 49 0D
1784"  20 20 20 20                    DB      '    K=;'
1788"  4B 3D 3B
178B"  50 52 41 47            M21:    DB      'PRAG COMUTARE =;'
178F"  20 43 4F 4D
1793"  55 54 41 52
1797"  45 20 3D 3B
                                      PAGE
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```
                        ;
                        ;interpretorul de comenzi
179B"                   CSEG
0000'  3E 18            TEST:   MVI     A,18H   ;<CLEAR>
0002'  CD 4437                  CALL    OUT8Q
0005'  3E 01                    MVI     A,1
0007'  CD 052F'                 CALL    MES
000A'  CD 4429                  CALL    IN8
000D'  78                       MOV     A,B
000E'  FE 41                    CPI     'A'
0010'  CA 0025'                 JZ      M1A
0013'  FE 44                    CPI     'D'
0015'  CA 0070'                 JZ      M1D
0018'  FE 54                    CPI     'T'
001A'  CA 0078'                 JZ      M1T
001D'  FE 51                    CPI     'Q'
001F'  CA 430C                  JZ      430CH
0022'  C3 0000'                 JMP     TEST
0025'  3E 06            M1A:    MVI     A,6     ;preluare K1 - K5
0027'  CD 052F'                 CALL    MES
002A'  CD 0505'                 CALL    PRNR
002D'  22 0000*                 SHLD    K1
0030'  CD 4441                  CALL    CRLF
0033'  3E 07                    MVI     A,7
0035'  CD 052F'                 CALL    MES
0038'  CD 0505'                 CALL    PRNR
003B'  22 0000*                 SHLD    K2
003E'  CD 4441                  CALL    CRLF
0041'  3E 08                    MVI     A,8
0043'  CD 052F'                 CALL    MES
0046'  CD 0505'                 CALL    PRNR
0049'  22 0000*                 SHLD    K3
004C'  3E 09                    MVI     A,9
004E'  CD 052F'                 CALL    MES
0051'  CD 0505'                 CALL    PRNR
0054'  22 0000*                 SHLD    K4
0057'  3E 0A                    MVI     A,10
0059'  CD 052F'                 CALL    MES
005C'  CD 0505'                 CALL    PRNR
005F'  22 1429"                 SHLD    K5
0062'  3E 15                    MVI     A,21
0064'  CD 052F'                 CALL    MES
0067'  CD 0505'                 CALL    PRNR
006A'  22 0000*                 SHLD    PRAG
006D'  C3 0000'                 JMP     TEST
                        ;
0070'  3E 00            M1D:    MVI     A,0     ;executie cu prescriere de
                                                ;la DAF
0072'  32 1427"                 STA     MOD
0075'  C3 0000*                 JMP     ETR
                        ;
0078'  3E 01            M1T:    MVI     A,1     ;executie in regim de testare
007A'  32 1427"                 STA     MOD
007D'  3E 18            AM2:    MVI     A,18H   ;<CLEAR>
```

```
007F'  CD 4437              CALL    OUT8Q
0082'  3E 02                MVI     A,2
0084'  CD 052F'             CALL    MES
0087'  CD 4429              CALL    IN8
008A'  78                   MOV     A,B
008B'  FE 47                CPI     'G'
008D'  CA 00A2'             JZ      M2G
0090'  FE 45                CPI     'E'
0092'  CA 0150'             JZ      EXE
0095'  FE 41                CPI     'A'
0097'  CA 0100'             JZ      M2A
009A'  FE 51                CPI     'Q'
009C'  CA 0000'             JZ      TEST
009F'  C3 007D'             JMP     AM2
                            ;
00A2'  3E 18                M2G:    MVI     A,18H   ;generare tabele
00A4'  CD 4437                      CALL    OUT8Q
00A7'  3E 03                        MVI     A,3
00A9'  CD 052F'                     CALL    MES
00AC'  CD 4429                      CALL    IN8
00AF'  78                           MOV     A,B
00B0'  FE 57                        CPI     'W'
00B2'  CA 00C2'                     JZ      M3W
00B5'  FE 50                        CPI     'P'
00B7'  CA 00C8'                     JZ      M3P
00BA'  FE 51                        CPI     'Q'
00BC'  CA 007D'                     JZ      AM2
00BF'  C3 00A2'                     JMP     M2G
00C2'  21 0000"             M3W:    LXI     H,TABW  ;generare tabel w
00C5'  C3 00FA'                     JMP     M5CAL
00C8'  3E 18                M3P:    MVI     A,18H   ;generare tabel up
00CA'  CD 4437                      CALL    OUT8Q
00CD'  3E 05                        MVI     A,5
00CF'  CD 052F'                     CALL    MES
00D2'  CD 4429                      CALL    IN8
00D5'  78                           MOV     A,B
00D6'  FE 50                        CPI     'P'
00D8'  CA 00E8'                     JZ      M5P
00DB'  FE 4E                        CPI     'N'
00DD'  CA 00ED'                     JZ      M5N
00E0'  FE 41                        CPI     'A'
00E2'  CA 00F2'                     JZ      M5A
00E5'  C3 00C8'                     JMP     M3P
00E8'  3E 00                M5P:    MVI     A,0
00EA'  C3 00F4'                     JMP     M5CON
00ED'  3E 02                M5N:    MVI     A,2
00EF'  C3 00F4'                     JMP     M5CON
00F2'  3E 01                M5A:    MVI     A,1
00F4'  32 1428"             M5CON:  STA     SENSP
00F7'  21 0400"                     LXI     H,TABUP
00FA'  CD 0256'             M5CAL:  CALL    GTAB
00FD'  C3 00A2'                     JMP     M2G
                            ;
0100'  3E 18                M2A:    MVI     A,18H   ;afisare tabele
0102'  CD 4437                      CALL    OUT8Q
0105'  3E 04                        MVI     A,4
```

```
0107'  CD 052F'                    CALL   MES
010A'  CD 4429                     CALL   IN8
010D'  78                          MOV    A,B
010E'  FE 57                       CPI    'W'
0110'  CA 012F'                    JZ     M4W
0113'  FE 50                       CPI    'P'
0115'  CA 0135'                    JZ     M4P
0118'  FE 54                       CPI    'T'
011A'  CA 013B'                    JZ     M4T
011D'  FE 4F                       CPI    'O'
011F'  CA 0141'                    JZ     M4O
0122'  FE 55                       CPI    'U'
0124'  CA 0147'                    JZ     M4U
0127'  FE 51                       CPI    'Q'
0129'  CA 007D'                    JZ     AM2
012C'  C3 0100'                    JMP    M2A
012F'  21 0000"            M4W:    LXI    H,TABW
0132'  C3 014A'                    JMP    M4CON
0135'  21 0400"            M4P:    LXI    H,TABUP
0138'  C3 014A'                    JMP    M4CON
013B'  21 0800"            M4T:    LXI    H,TABT
013E'  C3 014A'                    JMP    M4CON
0141'  21 0C00"            M4O:    LXI    H,TABO
0144'  C3 014A'                    JMP    M4CON
0147'  21 1000"            M4U:    LXI    H,TABU
014A'  CD 04BC'            M4CON:  CALL   AFPAR
014D'  C3 0100'                    JMP    M2A
                           ;
                           ;rulare in regim de testare
                           ;
0150'  21 0000             EXE:    LXI    H,0
0153'  22 142A"                    SHLD   STAR    ;STAR <- 0
0156'  7C                          MOV    A,H
0157'  32 0000*                    STA    START   ;START <- 0
015A'  C3 0000*                    JMP    ETR
                                   PAGE
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                        ;
015D'  3A 1427"         ARNT:   LDA     MOD     ;aici incepe segmentul
                        ;                       intercalat intre  ETR si ARN
0160'  B7                       ORA     A       ;testare MOD
0161'  CA 0246'                 JZ      ARNC
0164'  3A 0000*                 LDA     START
0167'  B7                       ORA     A       ;testare START
0168'  CA 017C'                 JZ      EXE1
016B'  2A 142A"                 LHLD    STAB
016E'  23                       INX     H
016F'  23                       INX     H
0170'  22 142A"                 SHLD    STAB    ;incrementare pointer tabele
0173'  11 0400                  LXI     D,400H
0176'  CD 0000*                 CALL    COMP2   ;verificare limita
0179'  DA 0234'                 JC      EXE2    ;salt daca STAB>400H
017C'  21 0000"         EXE1:   LXI     H,TABW  ;WK <- (TABW+STAB)
017F'  EB                       XCHG
0180'  2A 142A"                 LHLD    STAB
0183'  19                       DAD     D
0184'  7E                       MOV     A,M
0185'  32 0000*                 STA     WK
0188'  23                       INX     H
0189'  7E                       MOV     A,M
018A'  32 0001*                 STA     WK+1
018D'  21 0400"                 LXI     H,TABUP ;simulare perturbatie
0190'  EB                       XCHG
0191'  2A 142A"                 LHLD    STAB
0194'  19                       DAD     D
0195'  5E                       MOV     E,M
0196'  23                       INX     H
0197'  56                       MOV     D,M
0198'  3A 1428"                 LDA     SENSP   ;DE = up
019B'  B7                       ORA     A
019C'  CA 01A8'                 JZ      SENS0
019F'  3D                       DCR     A
01A0'  CA 01D9'                 JZ      SENS1
01A3'  EB                       XCHG
01A4'  CD 0000*                 CALL    CPL2
01A7'  EB                       XCHG            ;DE = -=up
01A8'  2A 0000*         SENS0:  LHLD    UK
01AB'  7A                       MOV     A,D
01AC'  17                       RAL             ;CY=1 daca up<0
01AD'  3A 0000*                 LDA     US      ;US=1 daca UK<0
01B0'  88                       ADC     0
01B1'  E6 01                    ANI     1       ;A=1 daca up si UK au semne
                                                ;diferite
01B3'  C2 01C0'                 JNZ     SENSD
01B6'  19                       DAD     D       ;UL=UK+up
01B7'  D2 01E9'                 JNC     SENSC
01BA'  21 9600                  LXI     H,9600H ;limitare superioara
01BD'  C3 01E9'                 JMP     SENSC
01C0'  CD 0000*         SENSD:  CALL    COMP2   ;CY=1 daca UK>up
01C3'  DA 01D1'                 JC      SENS1
01C6'  EB                       XCHG
```

```
01C7' 3A 0000*                      LDA     US
01CA' C6 01                         ADI     1
01CC' E6 01                         ANI     1       ;schimbare US
01CE' 32 0000*                      STA     US
01D1' EB                    SENSH:  XCHG
01D2' CD 0000*                      CALL    DIF2
01D5' EB                            XCHG            ;HL=!UK-US!
01D6' C3 01E9'                      JMP     SENSC
01D9' 2A 0000*              SENS1:  LHLD    UK
01DC' EB                            XCHG
01DD' CD 0000*                      CALL    DIF2
01E0' EB                            XCHG            ;HL=u(k)-up
01E1' 7C                            MOV     A,H
01E2' 17                            RAL
01E3' CA 01E9'                      JZ      SENSC
01E6' 21 0000                       LXI     H,0     ;limitare
01E9' 22 0000*              SENSC:  SHLD    UK
01EC' CD 0246'                      CALL    ARNC    ;apelare ARN
01EF' 21 0000"                      LXI     H,TAB0
01F2' EB                            XCHG
01F3' 2A 142A"                      LHLD    STAB
01F6' E5                            PUSH    H
01F7' 19                            DAD     D       ;HL=adresa
01F8' E5                            PUSH    H
01F9' 2A 0000*                      LHLD    T1K
01FC' 11 8000                       LXI     D,8000H
01FF' 19                            DAD     D       ;HL=theta1(k)+8000H
0200' EB                            XCHG
0201' E1                            POP     H
0202' 73                            MOV     M,E
0203' 23                            INX     H
0204' 72                            MOV     M,D
0205' 21 1000"                      LXI     H,TAB0
0208' D1                            POP     D       ;DE=STAB
0209' D5                            PUSH    D
020A' 19                            DAD     D       ;HL=adresa
020B' E5                            PUSH    H
020C' 2A 0000*                      LHLD    UK      ;HL=!u(k)!
020F' B7                            ORA     A       ;CY=0
0210' 7C                            MOV     A,H
0211' 1F                            RAR
0212' 67                            MOV     H,A
0213' 7D                            MOV     A,L
0214' 1F                            RAR
0215' 6F                            MOV     L,A     ;HL=!u(k)!/2
0216' 3A 0000*                      LDA     US
0219' B7                            ORA     A
021A' C4 0000*                      CNZ     CPL2    ;HL=u(k)/2
021D' 11 8000                       LXI     D,8000H
0220' 19                            DAD     D
0221' EB                            XCHG            ;DE=8000H+u(k)/2
0222' E1                            POP     H
0223' 73                            MOV     M,E
0224' 23                            INX     H
0225' 72                            MOV     M,D
0226' 21 0800"                      LXI     H,TAB1
```

```
0229'  D1                          POP     D
022A'  19                          DAD     D       ;HL=adresa
022B'  EB                          XCHG
022C'  2A 0000*                    LHLD    TK
022F'  EB                          XCHG
0230'  73                          MOV     M,E
0231'  23                          INX     H
0232'  72                          MOV     M,D
0233'  C9                          RET
0234'  AF                  EXE2:   XRA     A
0235'  D3 29                      OUT     29H     ;stop choopper
0237'  3E BF                      MVI     A,0BFH
0239'  32 20C9                    STA     20C9H
023C'  3E 49                      MVI     A,49H
023E'  32 20CA                    STA     20CAH   ;refacere adresa intr.timer
0241'  33                          INX     SP
0242'  33                          INX     SP      ;refacere stiva
0243'  C3 007D'                    JMP     AM2
                           ;
                           ;comutarea algoritmilor
                           ;
0246'  3A 1429"            ARNC:   LDA     K5
0249'  87                          ADD     A
024A'  6F                          MOV     L,A
024B'  26 00                       MVI     H,0
024D'  11 1400"                    LXI     D,TABCON
0250'  19                          DAD     D       ;HL=adresa din tabel
0251'  5E                          MOV     E,M
0252'  23                          INX     H
0253'  56                          MOV     D,M
0254'  EB                          XCHG            ;HL=adresa subr. ARN
0255'  E9                          PCHL
                           ;
                                PAGE
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                        ;subrutina generare  tabele
                        ;       intrare: HL=adresa de inceput a  tabelului
0256'  22 1417"         GTAB:   SHLD    MEM1
0259'  3E 18            GTAB1:  MVI     A,18H   ;<CLEAR>
025B'  CD 4437                  CALL    OUT8Q
025E'  3E 0B                    MVI     A,11
0260'  CD 052F'                 CALL    MES
0263'  CD 4429                  CALL    IN8     ;preluare caracter
0266'  78                       MOV     A,B
0267'  CD 4437                  CALL    OUT8Q   ;ecou
026A'  78                       MOV     A,B
026B'  FE 43                    CPI     'C'
026D'  CA 027D'                 JZ      GTC
0270'  FE 54                    CPI     'T'
0272'  CA 029D'                 JZ      GTT
0275'  FE 52                    CPI     'R'
0277'  CA 02FA'                 JZ      GTR
027A'  C3 0259'                 JMP     GTAB1
027D'  CD 4441          GTC:    CALL    CRLF
0280'  3E 0C                    MVI     A,12
0282'  CD 04FB'                 CALL    MEPROR
0285'  44                       MOV     B,H
0286'  4D                       MOV     C,L     ;BC=x1
0287'  2A 1417"                 LHLD    MEM1    ;N1
028A'  11 0400                  LXI     D,400H
028D'  EB                       XCHG
028E'  19                       DAD     D
028F'  2B                       DCX     H
0290'  2B                       DCX     H
0291'  EB                       XCHG            ;DE=N1+4000H-2
0292'  71               GTC1:   MOV     M,C
0293'  23                       INX     H
0294'  70                       MOV     M,B
0295'  23                       INX     H       ;(HL) <- x1
0296'  CD 0000*                 CALL    COMP2
0299'  D2 0292'                 JNC     GTC1
029C'  C9                       RET
                        ;
029D'  CD 4441          GTT:    CALL    CRLF
02A0'  3E 0F                    MVI     A,15
02A2'  CD 04FB'                 CALL    MEPROR
02A5'  22 1419"                 SHLD    MEM2    ;x1
02A8'  3E 0D            GTT1:   MVI     A,13
02AA'  CD 04FB'                 CALL    MEPROR  ;N/2 (nr. cuanta = adresa/2)
02AD'  7C                       MOV     A,H
02AE'  FE 02                    CPI     2
02B0'  D2 02A8'                 JNC     GTT1    ;verificare  HL<1FFH
02B3'  2B                       DCX     H
02B4'  2B                       DCX     H
02B5'  22 141B"                 SHLD    MEM3    ;(N-1)/2
02B8'  3E 10                    MVI     A,16
02BA'  CD 04FB'                 CALL    MEPROR
02BD'  22 141D"                 SHLD    MEM4    ;x2
02C0'  22 141B"                 SHLD    MEM3    ;(N-1)/2
```

```
02C3' 29                        DAD     H       ;nr. octeti din tabel=
                                                ; =2*nr. cuante
02C4' EB                        XCHG
02C5' 2A 1417"                  LHLD    MEM1    ;N1
02C8' 19                        DAD     D       ;HL=N1+N-1
02C9' EB                        XCHG            ;DE=N1+N-1
02CA' D5                        PUSH    D
02CB' 2A 1419"                  LHLD    MEM2    ;x1
02CE' 44                        MOV     B,H
02CF' 4D                        MOV     C,L     ;BC=x1
02D0' 2A 1417"                  LHLD    MEM1    ;N1
02D3' 71                GTT2:   MOV     M,C
02D4' 23                        INX     H
02D5' 70                        MOV     M,B
02D6' 23                        INX     H       ;(HL) <- x1
02D7' CD 0000*                  CALL    COMP2
02DA' D2 02D3'                  JNC     GTT2
02DD' 2A 141D"                  LHLD    MEM4    ;x2
02E0' 44                        MOV     B,H
02E1' 4D                        MOV     C,L     ;BC=x2
02E2' 2A 1417"                  LHLD    MEM1
02E5' 11 0400                   LXI     D,400H
02E8' 19                        DAD     D
02E9' 2B                        DCX     H
02EA' 2B                        DCX     H
02EB' EB                        XCHG            ;DE=N1+400H-2
02EC' E1                        POP     H
02ED' 23                        INX     H
02EE' 23                        INX     H       ;HL=N1+N-2
02EF' 71                GTT3:   MOV     M,C
02F0' 23                        INX     H
02F1' 70                        MOV     M,B
02F2' 23                        INX     H       ;(HL) <- x2
02F3' CD 0000*                  CALL    COMP2
02F6' D2 02EF'                  JNC     GTT3
02F9' C9                        RET
                        ;
02FA' CD 4441           GTR:    CALL    CRLF
02FD' 3E 0F                     MVI     A,15
02FF' CD 04FB'                  CALL    MEPRCR  ;x1
0302' 22 1419"                  SHLD    MEM2
0305' 3E 0E             GTR1:   MVI     A,14
0307' CD 04FB'                  CALL    MEPRCR
030A' 7C                        MOV     A,H
030B' FE 02                     CPI     2       ;verificare HL<200H
030D' D2 0305'                  JNC     GTR1
0310' 2B                        DCX     H
0311' 22 141B"                  SHLD    MEM3    ;(N-1)/2
0314' 3E 11                     MVI     A,17
0316' CD 04FB'                  CALL    MEPRCR
0319' 22 141D"                  SHLD    MEM4    ;p
031C' 3E 10                     MVI     A,16
031E' CD 04FB'                  CALL    MEPRCR
0321' 22 141F"                  SHLD    MEM5    ;x2
0324' 2A 141B"                  LHLD    MEM3    ;(N-1)/2
0327' 29                        DAD     H       ;N-1
```

```
0328'  EB                        XCHG
0329'  2A 1417"                  LHLD    MEM1    ;N1
032C'  19                        DAD     D
032D'  2B                        DCX     H
032E'  2B                        DCX     H
032F'  2B                        DCX     H
0330'  2B                        DCX     H
0331'  EB                        XCHG            ;DE=N1+N-4
0332'  2A 1419"                  LHLD    MEM2    ;x1
0335'  44                        MOV     B,H
0336'  4D                        MOV     C,L     ;BC=x1
0337'  2A 1417"                  LHLD    MEM1    ;HL=N1
033A'  71                GTR2:   MOV     M,C
033B'  23                        INX     H
033C'  70                        MOV     M,B
033D'  23                        INX     H       ;(HL) <- x1
033E'  CD 0000*                  CALL    COMP2
0341'  D2 033A'                  JNC     GTR2
0344'  E5                        PUSH    H       ;HL=adresa primei locatii
                                                 ;libere
0345'  2A 1417"                  LHLD    MEM1
0348'  11 0400                   LXI     D,400H
034B'  19                        DAD     D
034C'  2B                        DCX     H
034D'  2B                        DCX     H
034E'  EB                        XCHG            ;DE=N1+400H-2
034F'  E1                        POP     H
0350'  71                GTR3:   MOV     M,C
0351'  23                        INX     H
0352'  70                        MOV     M,B
0353'  23                        INX     H       ;(HL) <- BC
0354'  CD 0000*                  CALL    COMP2
0357'  D8                        RC
0358'  E5                        PUSH    H
0359'  D5                        PUSH    D
035A'  2A 141F"                  LHLD    MEM5    ;x2
035D'  50                        MOV     D,B
035E'  59                        MOV     E,C
035F'  CD 0000*                  CALL    COMP2
0362'  D2 036B'                  JNC     GTR4
0365'  2A 141D"                  LHLD    MEM4    ;p
0368'  09                        DAD     B
0369'  44                        MOV     B,H
036A'  4D                        MOV     C,L     ;BC <- BC+p
036B'  D1                GTR4:   POP     D
036C'  E1                        POP     H
036D'  C3 0350'                  JMP     GTR3
                         ;
                         ;subrutinele pentru afisare
                         ;
                         ;       intrari:DE = nr.cuantei
                         ;               HL = valoarea
                         ;               C  = nr.blancuri pina la '*'
0370'  C5                LIN:    PUSH    B
0371'  E5                        PUSH    H
0372'  EB                        XCHG
```

```
0373'  CD 03CA'          CALL   AF2      ;afisare numar cuanta
0376'  3E 20             MVI    A,' '
0378'  CD 4437           CALL   OUT8Q
037B'  E1                POP    H
037C'  CD 03CA'          CALL   AF2      ;afisare valoare
037F'  3E 20             MVI    A,' '
0381'  CD 4437           CALL   OUT8Q
0384'  C1          LIN6: POP    B
0385'  16 FF            MVI    D,0FFH
0387'  14          LIN1: INR    D
0388'  7A               MOV    A,D
0389'  FE 20             CPI    32
038B'  CA 03B4'          JZ     LIN4     ;ultima coloana
038E'  B9                CMP    C
038F'  CA 03A4'          JZ     LIN2     ;'*'
0392'  FE 00             CPI    0
0394'  CA 03AC'          JZ     LIN3     ;'!'
0397'  FE 10             CPI    16
0399'  CA 03AC'          JZ     LIN3     ;'!'
039C'  3E 20             MVI    A,' '
039E'  CD 4437           CALL   OUT8Q
03A1'  C3 0387'          JMP    LIN1
03A4'  3E 2A       LIN2: MVI    A,'*'
03A6'  CD 4437           CALL   OUT8Q
03A9'  C3 0387'          JMP    LIN1
03AC'  3E 21       LIN3: MVI    A,'!'
03AE'  CD 4437           CALL   OUT8Q
03B1'  C3 0387'          JMP    LIN1
03B4'  B9          LIN4: CMP    C
03B5'  CA 03C1'          JZ     LIN5     ;'*' si terminare
03B8'  3E 21             MVI    A,'!'
03BA'  CD 4437           CALL   OUT8Q    ;'!' si terminare
03BD'  CD 4441           CALL   CRLF
03C0'  C9                RET
03C1'  3E 2A       LIN5: MVI    A,'*'
03C3'  CD 4437           CALL   OUT8Q
03C6'  CD 4441           CALL   CRLF
03C9'  C9                RET
03CA'  11 2710     AF2:  LXI    D,10000 ;subrutina de afisare HL
03CD'  CD 03EA'          CALL   AF21
03D0'  11 03E8           LXI    D,1000
03D3'  CD 03EA'          CALL   AF21
03D6'  11 0064           LXI    D,100
03D9'  CD 03EA'          CALL   AF21
03DC'  11 000A           LXI    D,10
03DF'  CD 03EA'          CALL   AF21
03E2'  7D                MOV    A,L
03E3'  CD 45CC           CALL   BIN1
03E6'  CD 4437           CALL   OUT8Q
03E9'  C9                RET
03EA'  06 FF       AF21: MVI    B,0FFH
03EC'  04          AF22: INR    B
03ED'  7D                MOV    A,L
03EE'  93                SUB    E
03EF'  6F                MOV    L,A
03F0'  7C                MOV    A,H
```

```
03F1'  9A                        SBB     D
03F2'  67                        MOV     H,A     ;HL  <- HL-DE
03F3'  D2 03EC'                  JNC     AF22
03F6'  19                        DAD     D       ;HL=HL+DE
03F7'  78                        MOV     A,B
03F8'  E5                        PUSH    H
03F9'  CD 45CC                   CALL    BIN1
03FC'  CD 4437                   CALL    OUT8Q
03FF'  E1                        POP     H
0400'  C9                        RET
                          ;
                          ;subrutina scalare si stabilire origine pe Oy
                          ;       intrari:HL:adresa unde se afla valoarea
                          ;                  de afisat
                          ;               SOYM:M
                          ;               SOYN:N
                          ;       iesiri: C: nr. de blancuri
                          ;               HL:valoarea (pentru afisat)
0401'  5E                 SOY:   MOV     E,M
0402'  23                        INX     H
0403'  56                        MOV     D,M
0404'  23                        INX     H       ;DE <- x (valoarea)
0405'  D5                        PUSH    D
0406'  21 2000                   LXI     H,2000H ;HL=2^13
0409'  3A 1425"                  LDA     SOYN
040C'  B7                        ORA     A       ;CY=0
040D'  4F                        MOV     C,A
040E'  CA 041C'           SOY1:  JZ      SOY2
0411'  B7                        ORA     A
0412'  7C                        MOV     A,H
0413'  1F                        RAR
0414'  67                        MOV     H,A
0415'  7D                        MOV     A,L
0416'  1F                        RAR
0417'  6F                        MOV     L,A
0418'  0D                        DCR     C
0419'  C3 040E'                  JMP     SOY1    ;HL=(2^13)/(2^N)
041C'  22 1417"           SOY2:  SHLD    MEM1
041F'  EB                        XCHG            ;HL=x
0420'  0E 03                     MVI     C,3
0422'  B7                 SOY3:  ORA     A       ;CY=0
0423'  7C                        MOV     A,H
0424'  1F                        RAR

0425'  67                        MOV     H,A
0426'  7D                        MOV     A,L
0427'  1F                        RAR
0428'  6F                        MOV     L,A
0429'  0D                        DCR     C
042A'  C2 0422'                  JNZ     SOY3    ;HL=x*2^(-3)
042D'  3A 1424"                  LDA     SOYM
0430'  3D                        DCR     A       ;A=M-1
0431'  E5                        PUSH    H
0432'  21 0000                   LXI     H,0
0435'  B7                        ORA     A
0436'  CA 043E'           SOY4:  JZ      SOY5
0439'  19                        DAD     D
```

```
043A'  3D                        DCR     A
043B'  C3 0436'                  JMP     SOY4    ;HL=(M-1)*2^13/2^N
043E'  D1                SOY5:   POP     D       ;DE=x*2^(-3)
043F'  CD 0000*                  CALL    COMP2
0442'  CA 0466'                  JZ      SOY9
0445'  DA 046B'                  JC      SOY10   ;limitare inferioara
0448'  CD 0000*                  CALL    CPL2
044B'  19                        DAD     D
044C'  EB                        XCHG            ;DE=x*2^(-3)-(M-1)*2^13/2^N
044D'  2A 1417"                  LHLD    MEM1
0450'  CD 0000*                  CALL    COMP2
0453'  D2 046B'                  JNC     SOY10   ;limitare superioara
0456'  EB                        XCHG
0457'  3A 1425"                  LDA     SOYN
045A'  B7                        ORA     A
045B'  CA 0463'          SOY6:   JZ      SOY7
045E'  29                        DAD     H
045F'  3D                        DCR     A
0460'  C3 045B'                  JMP     SOY6    ;HL=(2^N)*(x*2^(-3)-(M-1)*
                                                 ; *2^13/2^N)
0463'  4C                SOY7:   MOV     C,H
0464'  E1                        POP     H
0465'  C9                        RET
0466'  26 00             SOY9:   MVI     H,0     ;'*' in prima coloana
0468'  C3 0463'                  JMP     SOY7
046B'  26 21             SOY10:  MVI     H,33    ;nu va afisa '*'
046D'  C3 0463'                  JMP     SOY7
                         ;
                         ;subrutina pentru trasarea graficului pentru 19 linii
                         ;din tabel
                         ;       intrari:HL:adresa de inceput a tabelului
                         ;               DE:nr. de ordine al primei valori care
                         ;                  se afiseaza
                         ;               GRAFK:din cite in cite valori se
                         ;                     afiseaza
0470'  3E 18             GRAF:   MVI     A,18H
0472'  CD 4437                   CALL    OUT8Q
0475'  42                        MOV     B,D
0476'  4B                        MOV     C,E     ;BC=nr. de ordine al primei
                                                 ;valori care se va afisa
0477'  C5                        PUSH    B
0478'  0B                        DCX     B       ;sare peste (BC-1) valori
0479'  78                        MOV     A,B
047A'  B1                        ORA     C
047B'  E5                        PUSH    H
047C'  CA 0487'          GRAF1:  JZ      GRAF2
047F'  23                        INX     H
0480'  23                        INX     H
0481'  0B                        DCX     B
0482'  78                        MOV     A,B
0483'  B1                        ORA     C
0484'  C3 047C'                  JMP     GRAF1
0487'  E3                GRAF2:  XTHL            ;HL=adr. de inceput a tabelului
0488'  11 4000                   LXI     D,4000H
048B'  19                        DAD     D
048C'  2B                        DCX     H
```

```
048D' EB                        XCHG            ;DE=adresa sfirsit tabel
048E' E1                        POP     H       ;HL=adr. primei valori de
                                                ;afisat
048F' C1                        POP     B
0490' 3E 12                     MVI     A,18
0492' 32 1419"                  STA     MEM2
0495' CD 0000*          GRAF3:  CALL    COMP2
0498' D8                        RC              ;termina afisarea daca se
                                                ;depaseste sfirsitul tabelului
0499' D5                        PUSH    D
049A' E5                        PUSH    H
049B' C5                        PUSH    B
049C' C5                        PUSH    B
049D' CD 0401'                  CALL    SOY     ;scalare
04A0' D1                        POP     D
04A1' CD 0370'                  CALL    LIN     ;trasare linie
04A4' C1                        POP     B
04A5' E1                        POP     H
04A6' D1                        POP     D
04A7' 3A 1426"                  LDA     GRAFK   ;sare K valori in tabel
04AA' 23                GRAF4:  INX     H
04AB' 23                        INX     H
04AC' 03                        INX     B
04AD' 3D                        DCR     A
04AE' C2 04AA'                  JNZ     GRAF4
04B1' 3A 1419"                  LDA     MEM2    ;contor linii afisate
04B4' 3D                        DCR     A
04B5' 32 1419"                  STA     MEM2
04B8' C2 0495'                  JNZ     GRAF3
04BB' C9                        RET
                        ;
                        ;subrutina pentru afisarea graficului unui tabel
                        ; intrari:HL:adresa de inceput a tabelului
                        ;         comenzi de la tastatura:
                        ;             C<nn..n>:afisare de la cuanta <nn..n>
                        ;             Q:iesire din regimul de afisare
04BC' E5                AFPAR:  PUSH    H
04BD' 3E 12                     MVI     A,18
04BF' CD 04FB'                  CALL    MEPROR
04C2' 7D                        MOV     A,L
04C3' 32 1425"                  STA     SOYN
04C6' 3E 13                     MVI     A,19

04C8' CD 04FB'                  CALL    MEPROR
04CB' 7D                        MOV     A,L
04CC' 32 1424"                  STA     SOYM
04CF' 3E 14                     MVI     A,20
04D1' CD 04FB'                  CALL    MEPROR
04D4' 7D                        MOV     A,L
04D5' 32 1426"                  STA     GRAFK
04D8' 11 0001                   LXI     D,1
04DB' E1                AFIS1:  POP     H
04DC' E5                        PUSH    H
04DD' CD 0470'                  CALL    GRAF
04E0' 3E 3F                     MVI     A,'?'
04E2' CD 4437                   CALL    OUT8C
04E5' CD 4429           AFIS2:  CALL    INS
```

```
04E8'  FE 51                    CPI     'Q'
04EA'  CA 04F9'                 JZ      AFIS6
04ED'  FE 43                    CPI     'C'
04EF'  C2 04E5'                 JNZ     AFIS2
04F2'  CD 0505'                 CALL    PRNR
04F5'  EB                       XCHG            ;HL=nr.primei linii
04F6'  C3 04DB'                 JMP     AFIS1
04F9'  E1               AFIS6:  POP     H
04FA'  C9                       RET
                        ;
                        ;subrutine intrare/iesire
                        ;
                        ;subrutina afisare mesaj, preluare numar, <CR>
04FB'  CD 052F'         MEPROR: CALL    MES
04FE'  CD 0505'                 CALL    PRNR
0501'  CD 4441                  CALL    CRLF
0504'  C9                       RET
                        ;
                        ;preluare numar zecimal de la tastatura si conversie
                        ;in hexa
                        ;       iesire:HL:valoarea hexa
0505'  21 1412"         PRNR:   LXI     H,ADNR  ;buffer caractere
0508'  E5               PRN0:   PUSH    H
0509'  CD 4429          PRN1:   CALL    IN8
050C'  78                       MOV     A,B
050D'  FE 0D                    CPI     13      ;<CR>
050F'  CA 0525'                 JZ      PRN2
0512'  FE 30                    CPI     30H
0514'  DA 0509'                 JC      PRN1
0517'  FE 3A                    CPI     3AH
0519'  D2 0509'                 JNC     PRN1    ;testare caracter valid (cifra
051C'  CD 4437                  CALL    OUT8Q   ;ecou
051F'  E1                       POP     H
0520'  70                       MOV     M,B     ;pune caracterul in buffer
0521'  23                       INX     H
0522'  C3 0508'                 JMP     PRN0
0525'  E1               PRN2:   POP     H
0526'  36 00                    MVI     M,0     ;pune 0 in buffer
                                                 ;(asa cere subrutina ADNR)
0528'  01 1412"                 LXI     B,ADNR
052B'  CD 4534                  CALL    ADEC    ;conversie sir ASCII -> nr.hex
052E'  C9                       RET
                        ;
                        ;subrutina afisare mesaje
                        ;       intrare:A:nr. de ordine al mesajului
                        ;       obs.:mesajele se termina cu ';'
052F'  21 142B"         MES:    LXI     H,MM    ;adr. primului mesaj
0532'  3D                       DCR     A
0533'  B7               JPMES:  ORA     A       ;sare peste N-1 mesaje
0534'  47                       MOV     B,A
0535'  CA 0544'                 JZ      AFMES
0538'  7E               JPM1:   MOV     A,M
0539'  23                       INX     H
053A'  FE 3B                    CPI     ';'
053C'  C2 0538'                 JNZ     JPM1
053F'  78                       MOV     A,B
```

```
0540'  3D                        DCR     A
0541'  C3 0533'                  JMP     JPMES
0544'  7E              AFMES:    MOV     A,M     ;afiseaza mesajul
0545'  23                        INX     H
0546'  FE 3B                     CPI     ';'
0548'  C8                        RZ
0549'  CD 4437                   CALL    OUT8Q
054C'  C3 0544'                  JMP     AFMES
                                 END
```

Macros:

Symbols:

1421"	ACON	4534	ADEC	1412"	ADNR
03CA'	AF2	03EA'	AF21	03EC'	AF22
04DB'	AFIS1	0435'	AFIS2	04F9'	AFIS6
0544'	AFMES	04BC'	AFPAR	007D'	AM2
1400*	ARMA1	1402*	ARMA2	0246I'	ARNC
1406*	ARNC1	1408*	ARNC2	1404*	ARNPI
015DI'	ARNT	45CC	BIN1	0496*	COMP2
0449*	CPL2	4441	CRLF	01DF*	DIF2
4584	DOUT	015B*	ETR	0150'	EXE
017C'	EXE1	0234'	EXE2	0470'	GRAF
047C'	GRAF1	0487'	GRAF2	0495'	GRAF3
04AA'	GRAF4	1426"	GRAFK	0256'	GTAB
0259'	GTAB1	027D'	GTC	0292'	GTC1
02FA'	GTR	0305'	GTR1	033A'	GTR2
0350'	GTR3	036B'	GTR4	029D'	GTT
02A8'	GTT1	02D3'	GTT2	02EF'	GTT3
4429	IN8	0538'	JPM1	0533'	JPMES
002E*	K1	003C*	K2	004A*	K3
0055*	K4	1429"	K5	0370'	LIN
0387'	LIN1	03A4'	LIN2	03AC'	LIN3
03B4'	LIN4	03C1'	LIN5	03E4'	LIN6
142B"	M1	1667"	M10	166B"	M11
169F"	M12	16A9"	M13	16CE"	M14
16F1"	M15	1705"	M16	1717"	M17
1726"	M18	1749"	M19	0025'	M1A
0070'	M1D	0078'	M1T	14BA"	M2
1764"	M20	178B"	M21	0100'	M2A
00A2'	M2G	1531"	M3	00C8'	M3P
00C2'	M3W	1585"	M4	014A'	M4CON
0141'	M40	0135'	M4P	013B'	M4T
0147'	M4U	012F'	M4W	1604"	M5
00F2'	M5A	00FA'	M5CAL	00F4'	M5CON
00ED'	M5N	00E8'	M5P	1657"	M6
165B"	M7	165F"	M8	1663"	M9
1417"	MEM1	1419"	MEM2	141B"	MEM3
141D"	MEM4	141F"	MEM5	04FB'	MEPRCR
052F'	MES	1427"	MOD	4437	OUTSQ
006B*	PRAG	0508'	PRNO	0509'	PRN1
0525'	PRN2	0505'	PRNR	01A8'	SENSO
01D9'	SENS1	01E9'	SENSC	01C0'	SENSD
01D1'	SENSM	1428"	SENSP	0401'	SOY
040E'	SOY1	046B'	SOY10	041C'	SOY2
0422'	SOY3	0436'	SOY4	043E'	SOY5
045B'	SOY6	0463'	SOY7	0466'	SOY9
1424"	SOYM	1425"	SOYN	142A"	STAB
0165*	START	01FA*	T1K	1400"	TABCON
0C00"	TAB0	0800"	TAB1	1000"	TABU
0400"	TABUP	0000"	TABX	0000I'	TEST
022D*	TK	020D*	UK	0217*	US
018B*	WK				

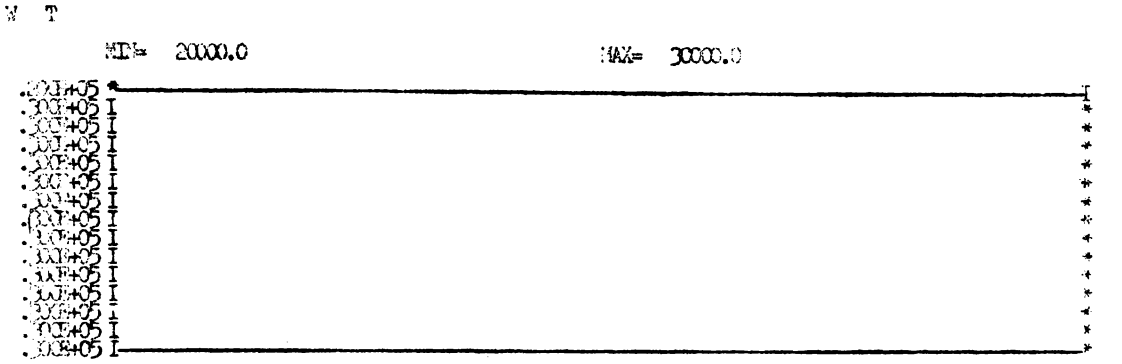
No Fatal error(s)

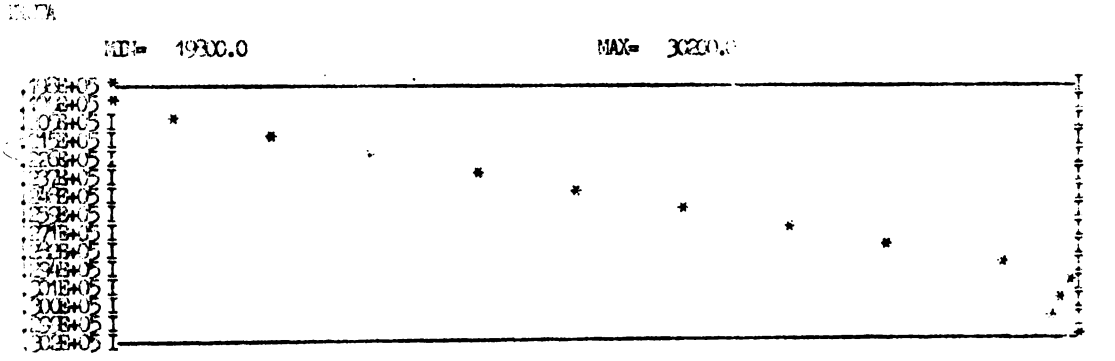
ANEXA A10

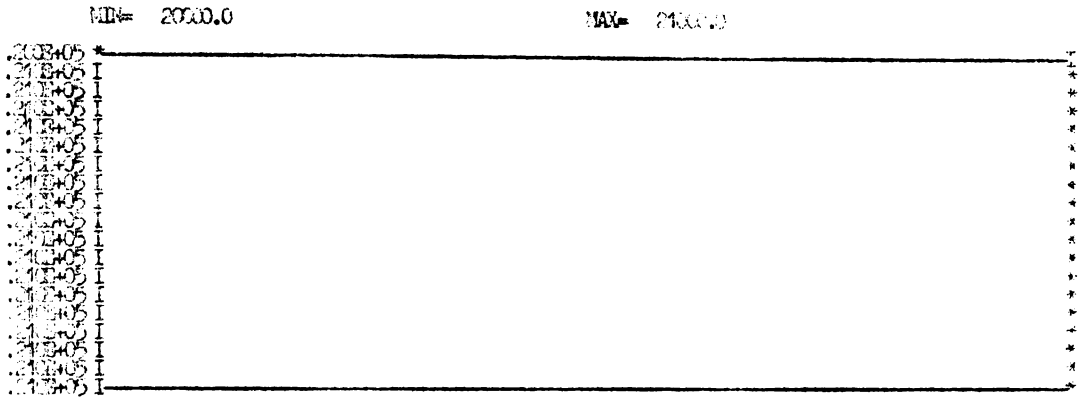
REZULTATE EXPERIMANTALE OBTINUTE CU PROGRAMUL TEST IMPLEMENTAT PE MODEL EXPERIMENTAL

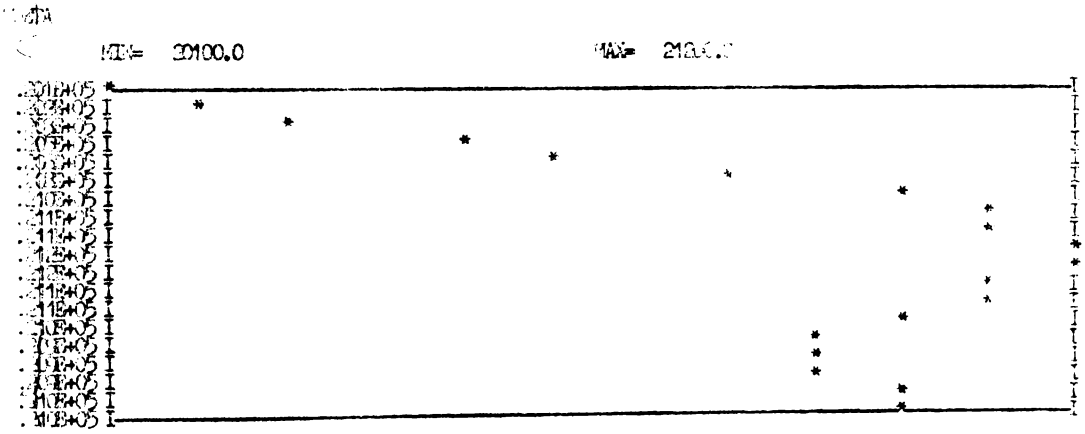
Rezultatele programului de TESTARE IN CADRUL
MODELULUI EXPERIMENTAL AL S.R.A.Ps

-perioade de esantionare : Te = 12.5 msec
-referinta de pozitie : conform graficului V
-perturbatia simulata : up = 0









ANEXA A11

PROGRAM DE VERIFICARE PE CALCULATOR A SUBRUTINEI DE IMPLEMENTARE IN LIMBAJ DE ASAMBLARE A ALGORITMULUI ARMA-1

1. PROGRAMUL PRINCIPAL - IN LIMBAJ FORTRAN
2. SUBPROGRAMUL ARMA-1 - IN LIMBAJ DE ASAMBLARE

1. Algoritm de reglare numeric, clasic PI
2. Combinatia algoritmelor ARMA-1 si ARN-PI
3. Combinatia algoritmelor ARMA-2 si ARN-PI

```
      PROGRAM simulare
      DIMENSION th(85),th1(85),s(85),u(85),v(85)
      REAL k1
      INTEGER TK,WK,UK,T1K
      INTEGER K2,K3,K4
      BYTE US
C
C parametri PCE
C
      Te=12.5E-3
      Ts=325.52E-9
      Ta=1.8E-3
      Tm=47.0E-3
      A=0.457
      d=0.1028
C
C coeficienti simulare PCE
C
      div=8*Ta*Tm+4*Te*Tm+2*Te*Te
      Beta1=(24*Ta*Tm+4*Te*Tm-2*Te*Te)/div
      Beta2=(-24*Ta*Tm+4*Te*Tm+2*Te*Te)/div
      Beta3=(8*Ta*Tm-4*Te*Tm+2*Te*Te)/div
      Beta4=(A*Te**3)/div
C
C preluare treapta referinta
C
      WRITE(3,103)
103   FORMAT(1X,'w=')
      READ(1,102) w
102   FORMAT(F15.7)
      WRITE(3,201)
201   FORMAT(1X,'K2=')
      READ(1,204) K2
      WRITE(3,202)
202   FORMAT(1X,'K3=')
      READ(1,204) K3
      WRITE(3,203)
203   FORMAT(1X,'K4=')
      READ(1,204) K4
204   FORMAT(I6)
C
C initializari
C
      DO 10 k=1,3
        th(k)=0.
        th1(k)=0.
        u(k)=0
        v(k)=0
10    CONTINUE
```

```
C
C calcule simulare
C
      DO 11 k=3,85
        WK=IFIX(w)
        TK=IFIX(th(k))
        CALL ARMA1(TK,WK,K2,K3,K4,UK,US,T1K)
        th1(k)=FLOAT(T1K)
        u(k)=FLOAT(UK)
        IF(u(k).LT.0) u(k)=32768+(32768+u(k))
        IF(US.EQ.1) u(k)=-u(k)
C
C model PCP-2
C
1005    th(k+1)=Beta1*th(k)+Beta2*th(k-1)+Beta3*th(k-2)
        th(k+1)=th(k+1)+Beta4*(u(k)+3*u(k-1)+3*u(k-2)+u(k-3))
1006    CONTINUE
C       WRITE(3,113) th(k),th1(k),u(k)
C113     FORMAT(2X,3E15.7)
11    CONTINUE
      CALL grafic(th,'THETA')
      CALL grafic(th1,'OMEGA')
      CALL grafic(u,'U    ')
      END
```

```
C
      SUBROUTINE grafic(vect,mes)
      BYTE line(100),mes(5)
      INTEGER tras
      REAL vect(85),ymin,ymax,deltay
C
      WRITE(3,114) mes
114   FORMAT(2X,5A1,1X,'TRASARE (0/1):')
      READ(1,115) tras
115   FORMAT(I2)
      IF(tras.NE.1) GOTO 1007
C
      WRITE(2,116) mes
116   FORMAT(2X,5A1,/)
      ymin=vect(1)
      ymax=vect(1)
      DO 12 i=3,85
        IF (vect(i).LT.ymin) ymin=vect(i)
        IF (vect(i).GT.ymax) ymax=vect(i)
12    CONTINUE
      WRITE(2,117) ymin,ymax
117   FORMAT (12X,'MIN=',G14.6,32X,'MAX=',G14.6,/)
      deltay=(ymax-ymin)/99.
      DO 14 i=3,85
        DO 13 j=1,100
          line(j)=' '
          IF((i.EQ.3).OR.(i.EQ.85)) line(j)='-'
          IF((j.EQ.1).OR.(j.EQ.100)) line(j)='I'
          IF(((-ymin).GE.((j-1)*deltay)).AND.((-ymin).LT.(j*deltay)))
     *    line(j)='I'
          IF(((vect(i)-ymin).GE.((j-1)*deltay))
     *    .AND.((vect(i)-ymin).LT.(j*deltay)))
     *    line(j)='*'
13      CONTINUE
        WRITE(2,118) vect(i),line
118     FORMAT (1X,G10.3,1X,100A1)
14    CONTINUE
1007  RETURN
      END
```

```
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                        NAME    ('ARMA1')
                ;
                ;algoritm ARMA-1
                ;
                        PUBLIC  ARMA1,K2,K3,K4
                        PUBLIC  TK1,T1K1,UK1,VK2T,T1K
                        PUBLIC  UK,TK,UK,US
                        PUBLIC  APN3
                        EXT     MUL12,CPL3,MUL12I,CPL2,ADD3V,ADD3
                        EXT     ROT3R,DIF2,COMP2,ROT3LV
0000'                   TK:     DS      2
0002'                   UK:     DS      2
0004'                   UK:     DS      2
0006'                   US:     DS      1
                        ;variabile
0007'                   TK1:    DS      2       ;theta(k-1)
0009'                   T1K:    DS      2       ;omega(k)
000B'                   T1K1:   DS      2       ;omega(k-1)
000D'                   UK1:    DS      3       ;u(k-1)
0010'                   VK2T:   DS      3       ;v~(k-2)
0013'   0040            K2:     DW      64      ;3.2^6
0015'   0FA0            K3:     DW      4000    ;0.1*P
0017'   000A            K4:     DW      10      ;-0.514*C
                        ;program
0019'   7E              ARMA1:  MOV     A,M
001A'   32 0000'                STA     TK
001D'   23                      INX     H
001E'   7E                      MOV     A,M
001F'   32 0001'                STA     TK+
0022'   EB                      XCHG
0023'   7E                      MOV     A,M
0024'   32 0002'                STA     UK
0027'   23                      INX     H
0028'   7E                      MOV     A,M
0029'   32 0003'                STA     UK+
002C'   60                      MOV     H,B
002D'   69                      MOV     L,C
002E'   5E                      MOV     E,M
002F'   23                      INX     H
0030'   56                      MOV     D,M
0031'   23                      INX     H
0032'   EB                      XCHG
0033'   7E                      MOV     A,M
0034'   32 0013'                STA     K2
0037'
        23                      INX     H
0038'   7E                      MOV     A,M
0039'   32 0014'                STA     K2+
003C'   EB                      XCHG
003D'   5E                      MOV     E,M
003E'   23                      INX     H
003F'   56                      MOV     D,M
0040'   23                      INX     H
0041'   EB                      XCHG
0042'   7E                      MOV     A,M
0043'   32 00 5'                STA     K3
0046'   23                      INX     H
```

```
0047'   7E                  MOV     A,M
0048'   32 0016'            STA     K3+1
004B'   EB                  XCHG
004C'   5E                  MOV     E,M
004D'   23                  INX     H
004E'   56                  MOV     D,M
004F'   23                  INX     H
0050'   EB                  XCHG
0051'   7E                  MOV     A,M
0052'   32 0017'            STA     K4
0055'   23                  INX     H
0056'   7E                  MOV     A,M
0057'   32 0018'            STA     K4+1
005A'   D5                  PUSH    D
                    ;
005B'   2A 0000'            LHLD    TK
005E'   EB                  XCHG
005F'   2A 0007'            LHLD    TK1
0062'   CD 0000*            CALL    DIF2    ;DE=omega(k)=theta(k)-
                                            ; -theta(k-1)
0065'   2A 0000'            LHLD    TK
0068'   22 0007'            SHLD    TK1     ;theta(k-1) <- theta(k)
006B'   EB                  XCHG
006C'   22 0009'            SHLD    T1K
006F'   EB                  XCHG
0070'   2A 000B'            LHLD    T1K1
0073'   CD 0000*            CALL    DIF2    ;DE=omega1(k)=omega(k)-
                                            ; -omega(k-1)
0076'   2A 0009'            LHLD    T1K
0079'   22 000B'            SHLD    T1K1    ;omega(k-1) <- omega(k)
007C'   42                  MOV     B,D
007D'   63                  MOV     H,E
007E'   2E 00               MVI     L,0     ;BHL=omega1(k)*2^8
0080'   4A                  MOV     C,D
0081'   53                  MOV     D,E
0082'   5D                  MOV     E,L     ;CDE=omega1(k)*2^8
0083'   CD 0000*            CALL    ADD3V   ;BHL=omega1(k)*2^9
0086'   CD 0000*            CALL    ROT3R   ;CDE=omega1(k)*2^7
0089'   CD 0000*            CALL    ADD3V   ;BHL=omega(k)*(2^7+2^9)
008C'   CD 0000*            CALL    CPL3    ;BHL=-omega(k)*(2^7+2^9)
008F'   EB                  XCHG
0090'   48                  MOV     C,B     ;CDE=-omega(k)*(2^7+2^9)
0091'   2A 000D'            LHLD    UK1
0094'   3A 000F'            LDA     UK1+2
0097'   47                  MOV     B,A     ;BHL=u(k-1)
0098'   CD 0000*            CALL    ADD3V   ;BHL=v(k-1)
009B'   EB                  XCHG
009C'   48                  MOV     C,B     ;CDE=v(k-1)
009D'   21 0000             LXI     H,0
00A0'   06 00               MVI     B,0     ;BHL=0
00A2'   CD 0000*            CALL    ROT3R
00A5'   CD 0000*            CALL    ADD3
00A8'   CD 0000*            CALL    ROT3R
00AB'   CD 0000*            CALL    ROT3R
00AE'   CD 0000*            CALL    ADD3    ;BHL=v(k-1)*(2^-1+2^-3)
00B1'   EB                  XCHG
```

```
00B2'  2A 0010'                LHLD    VK2T
00B5'  EB                      XCHG
00B6'  3A 0012'                LDA     VK2T+2
00B9'  4F                      MOV     C,A     ;CDE=v~(k-2)
00BA'  CD 0000*                CALL    ROT3R
00BD'  CD 0000*                CALL    ROT3R
00C0'  CD 0000*                CALL    ADD3
00C3'  CD 0000*                CALL    ROT3R
00C6'  CD 0000*                CALL    ADD3    ;BHL=v~(k-1)
00C9'  22 0010'                SHLD    VK2T
00CC'  78                      MOV     A,B
00CD'  32 0012'                STA     VK2T+2  ;v~(k-2) <- v~(k-1)
00D0'  2A 0000'                LHLD    TK
00D3'  EB                      XCHG            ;DE=theta(k)
00D4'  2A 0002'                LHLD    WK      ;HL=w(k)
00D7'  CD 0000*                CALL    COMP2
00DA'  D2 00DE'                JNC     ARN1    ;theta(k) > w(k)
00DD'  EB                      XCHG            ;face DE >= HL
00DE'  F5                ARN1: PUSH    PSW     ;CY=1 dac  e(k) < 0
00DF'  CD 0000*                CALL    DIF2    ;DE= !e(k)!
00E2'  3A 0013'                LDA     K2
00E5'  4F                      MOV     C,A
00E6'  CD 0000*                CALL    MUL12   ;BHL=K2*!e(k)! > 0
00E9'  6C                      MOV     L,H
00EA'  60                      MOV     H,B
00EB'  06 00                   MVI     B,0     ;BHL=K2*!e(k)!*2^-8
00ED'  F1                      POP     PSW     ;CY=1 dac  e(k) < 0
00EE'  DC 0000*                CC      CPL3    ;BHL=K2*e(k)*2^-8
00F1'  EB                      XCHG
00F2'  48                      MOV     C,B     ;CDE=K2*e(k)*2^-8
00F3'  2A 0009'                LHLD    TMK     ;HL=omega(k)
00F6'  7C                      MOV     A,H
00F7'  17                      RAL             ;CY=1 dac  HL < 0
00F8'  3E 00                   MVI     A,0
00FA'  D2 00FE'                JNC     ARN2
00FD'  2F                      CMA
00FE'  47                ARN2: MOV     B,A     ;BHL=omega(k)
00FF'  CD 0000*                CALL    ADD3    ;BHL=s(k)
0102'  78                      MOV     A,B
0103'  17                      RAL             ;CY=1 dac  s(k) < 0
0104'  F5                      PUSH    PSW
0105'  2A 0009'                LHLD    TMK
0108'  EB                      XCHG            ;DE=omega(k)
0109'  3A 0017'                LDA     K4
010C'  4F                      MOV     C,A
010D'  CD 0000*                CALL    MUL12   ;BHL=K4*omega(k)
0110'  CD 0000*                CALL    CPL3
0113'  5D                      MOV     E,L
0114'  54                      MOV     D,H
0115'  48                      MOV     C,B     ;CDE=K4*omega(k)
0116'  CD 0000*                CALL    ROT3LV
0119'  CD 0000*                CALL    ROT3LV
011C'  CD 0000*                CALL    ROT3LV
011F'  CD 0000*                CALL    ROT3LV  ;CDE=K4*omega(k)*2^4
0122'  2A 0015'                LHLD    K3
0125'  06 00                   MVI     B,0     ;BHL=K3
```

```
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0127'   F1                               POP     PSW     ;CY=1 daca s(k) < 0
0128'   D5                               PUSH    D
0129'    D4  0000*                       CNC     CPL3    ;BHL=-K3*sgn{s(k)}
012C'   D1                               POP     D
012D'   CD 0000*                         CALL    ADD3V   ;BHL=omega1D(k)
                                 ;       XCHG
                                 ;       MOV     C,B     ;CDE=omega1D(k)
                                 ;       LHLD    VK2T
                                 ;       LDA     VK2T+2
                                 ;       MOV     B,A     ;BHL=v~(k-2)
                                 ;       CALL    ADD3V   ;BHL=u(k)
0130'   22 000D'                         SHLD    UK1
0133'   78                               MOV     A,B
0134'   32 000F'                         STA     UK1+2   ;v(k-1) <- u(k)
0137'   17                               RAL
0138'   3E 00                           MVI     A,0
013A'   17                               RAL             ;A=1 daca u(k) < 0
013B'   32 0006'                         STA     US
013E'   1F                               RAR
013F'   DC 0000*                         CC      CPL3    ;BHL=!u(k)!
0142'   78                               MOV     A,B
0143'   B7                               ORA     A
0144'   CA 014A'                         JZ      ARN3
0147'   21 FFFF                         LXI     H,0FFFFH  ;limitare superioara !u(k)!
014A'   22 0004'                 ARN3:   SHLD    UK
014D'   E1                               POP     H
014E'   5E                               MOV     E,M
014F'   23                               INX     H
0150'   56                               MOV     D,M
0151'   23                               INX     H
0152'   EB                               XCHG
0153'   3A 0004'                         LDA     UK
0156'   77                               MOV     M,A
0157'   23                               INX     H
0158'   3A 0005'                         LDA     UK+1
015B'   77                               MOV     M,A
015C'   EB                               XCHG
015D'   5E                               MOV     E,M
015E'   23                               INX     H
015F'   56                               MOV     D,M
0160'   23                               INX     H
0161'   EB                               XCHG
0162'   3A 0006'                         LDA     US
0165'   77                               MOV     M,A
0166'   EB                               XCHG
0167'   5E                               MOV     E,M
0168'   23                               INX     H
0169'   56                               MOV     D,M
016A'   23                               INX     H
016B'   EB                               XCHG
016C'   3A 0009'                         LDA     T1K
016F'   77                               MOV     M,A
0170'   23                               INX     H
0171'   3A 000A'                         LDA     T1K+1
0174'   77                               MOV     M,A
0175'   C9                               RET
```

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END

Macros:

Symbols:

0100*	ADD3	012E*	ADD3V	0019I'	ARN1
00DE'	ARN1	00FE'	ARN2	014AI'	ARN3
00D8*	COMP2	0000*	CPL2	0140*	CPL3
00E0*	DIF2	0013I'	K2	0015I'	K3
0017I'	K4	010E*	MUL12	0000*	MUL12S
0120*	ROT3LV	00C4*	ROT3R	0009I'	T1K
000BI'	T1K1	0000I'	TK	0007I'	TK1
0004I'	UK	000DI'	UK1	0006I'	US
0010I'	VK2T	0002I'	WK		

No Fatal error(s)

ANEXA A12

REZULTATELE VERIFICARII PE CALCULATOR A SUBPROGRAMULUI DE IMPLEMENTARE IN LIMBAJ DE ASAMBLARE A ALGORITMULUI DE REGLARE ARMA - 1

Rezultatele programului de TESTARE PRIN SIMULARE
a subrutinei care implementeaza ARMA

- algoritm de reglare : tip ARMA - 1
  cu compensarea perturbatiilor
  cu limitarea modulului comenzii
  N2 = 64
  N3 = 5000
  N4 = 10
- modelul procesului condus extins : PCE - 2
- perioada de esantionare : Te = 12.5 msec
- referinta de pozitie : treapta cu amplitudinea w = 500
- perturbatia simulata : up = 0