プログラムのページ

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6701. Incremental step motion による境界追跡

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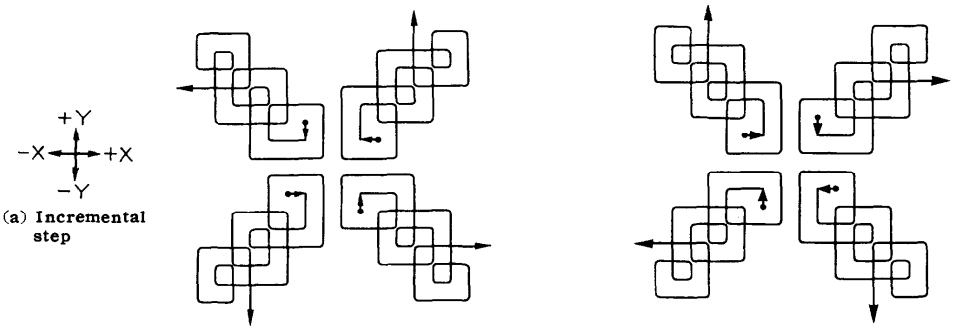
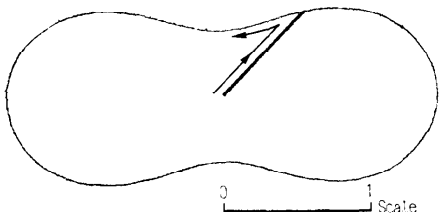
方法．＋X，－X，＋Y，および －Y の 4 種類の incremental step を組み合わせて，**第1図**のような8種類の precession を考える．初期 step が4種類と，precession の向きが2種類ある．任意の点から



(a) Incremental step　(b) Clockwise precession　(c) Counterclockwise precession

第1図　Precession

任意の初期 step で precession をはじめて，ある step が境界を越えるとその step を初期 step とし，逆く向きの precession をはじめる．これをくりかえすことによって境界を追跡する．境界としては函数値の正負，図形の黒白などの情報を用いて，いろいろな目的に使うことができる．**第2図**にグラフ追跡の例を示す．



第2図　$(x^2+y^2+1)^2=4x^2+1.1^4$

FORTRAN プログラム．

```
C
C     ..................................................................
C
C          SAMPLE MAIN PROGRAM OF CURVE FOLLOWING
C
C          F-CARD SPECIFYING EXTERNAL FUNCTION NAME
C
F          FUNC
C
C          INITIALIZATION
C
           IX=-1
           IY=0
           ID=5
           IM=-1
```

```
      ISCALE=250
      IUB=20000
      CALL PENUP
      CALL EPUNCH (ID)
C
C     SEARCH THE BOUNDARY BY PRECESSION
C
      CALL SEARCH (IX, IY, ID, IM, FUNC, ISCALE, IUB)
C
C     STORE THE COORDINATE OF THE STARTING POINT
C
      IXST=IX
      IYST=IY
C
C     START CURVE FOLLOWING
C
      CALL PENDWN
      ISW=1
   10 CALL SEARCH (IX, IY, ID, IM, FUNC, ISCALE, IUB)
C
C     TEST FOR LOOP-CLOSING
C
   20 IF (((IX-IXST)**2+(IY-IYST)**2)-9) 25, 25, 30
   25 IF (ISW) 35, 35, 10
   30 ISW=0
      GO TO 10
C
C     FINILIZATION
C
   35 CALL PENUP
      CALL EXIT
      END
C
C     ..........
C
C     SUBROUTINE SEARCH
C
C     PURPOSE
C        SEARCH THE BOUNDARY BY PRECESSING THE PROBE.  THIS ROUTINE IS
C        NORMALLY USED IN THE PERFORMANCE OF CURVE PLOTTING OR CURVE
C        FOLLOWING BY THE INCREMENTAL DIGITAL PLOTTER.
C
C     USAGE
C        CALL SEARCH (IX, IY, ID, IM, FUNC, ISCALE, IUB)
```

```
C
C       DESCRIPTION OF PARAMETERS
C         IX      - INPUT VARIABLE COTAINING THE X-COORDINATE FROM WHICH
C                   THE PRECESSION BEGINS.  ON RETURNING IT CONTAINS THE
C                   X-COORDINATE OF THE POINT WHICH IS ATTAINED BY THE
C                   SEQUENCE OF STEPS SUCH THAT THE LAST OF WHICH CROSSES THE
C                   BOUNDARY FOR THE FIRST TIME IN THE PRECESSION.
C         IY      - SAME AS IX EXCEPT FOR Y-COORDINATE.
C         ID      - CODE OF THE STEP (1 FOR +X, 3 FOR +Y, 5 FOR -X, 7 FOR
C                   -Y) SPECIFYING THE FIRST STEP IN THE PRECESSION. THE
C                   ACTUAL STEP PERFORMED IS THE STEP NEXT TO ID.
C                   ON RETURNING IT CONTAINS THE CODE CORRESPONDING TO THE
C                   LAST STEP.
C         IM      - CODE SPECIFYING THE MODE OF THE PRECESSION.
C                         -1 FOR CLOKWISE MODE,
C                         +1 FOR COUNTERCLOCKWISE MODE.
C         FUNC    - THE NAME OF THE FUNCTION OF TWO VARIABLES F(X, Y) WHOSE
C                   BOUNDARY, AT WHICH THE SIGN OF THE FUNCTION VALUE
C                   CHANGES, IS TO BE FOLLOWED.  THE ACTUAL NAME MUST BE
C                   SPECIFIED BY AN F-CARD IN THE CALLING PROGRAM.
C         ISCALE  - SCALE FACTOR OF THE MAGNITUDE OF THE STEP SUCH THAT
C                   ISCALE STEPS CORRESPOND TO THE UNIT FOR CALCULATION OF
C                   F(X, Y).
C         IUB     - UPPER BOUND OF THE NUMBER OF CYCLES IN PRECESSION. (ONE
C                   CYCLE CORRESPONDS TO 20 STEPS) PRECESSION IS CEASED
C                   EVEN IF NO BOUNDARY IS ENCOUNTERED.
C
C       REMARKS
C           CLOSER TRACE IS OBTAINED BY CONNECTING (IX, IY) DERIVED FROM
C           SUCCESSIVE CALL TO THIS ROUTINE, BY THE APPROXIMATE STREIGHT
C           LINE ALLOWING 45-DEGREE DIRECTION STEPS.
C           APPROPRIATE MEASURE MUST BE TAKEN IN THE CALLING PROGRAM
C           TO AVOID ENTERING INTO BLIND ALLEY.
C
C       METHOD
C         REFER TO CALCOMP REPORT. (INFORMATION BULLETIN NO. 139)
C
      SUBROUTINE SEARCH (IX, IY, ID, IM, FUNC, ISCALE, IUB)
C
C       SAVE THE SIGN OF THE FUNCTION
C
      SCALE=ISCALE
      X=FLOATF(IX)/SCALE
      Y=FLOATF(IY)/SCALE
```

```
      IDS=XSIGNF (1, XINTF (FUNCF (X, Y)))
      IDI=2*XSIGNF (1, IM)
C
C     PERFORM PRECESSION
C
      DO 60 I=1, IUB
      DO 60 J=1, 8
C
C     CALCULATE THE NUMBER OF STEPS IN THE PRECESSION CYCLE
C
      ISTEP=XMODF ((J+1)/2, 4)+1
C
C     CALCULATE THE STEP CODE
C
      ID=XMODF (ID+IDI+8, 8)
      IDD=(ID+1)/2
      DO 60 K=1, ISTEP
C
C     CALCULATE THE NEW COORDINATE
C
      GO TO (10, 20, 30, 40), IDD
   10 IX=IX+1
      GO TO 50
   20 IY=IY+1
      GO TO 50
   30 IX=IX-1
      GO T0 50
   40 IY=IY-1
C
C     OUTPUT THE STEP CODE
C
   50 CALL EPUNCH (ID)
C
C     TEST WHETHER THE SIGN OF THE FUNCTION CHANGES
C
      X=FLOATF(IX)/SCALE
      Y=FLOATF(IY)/SCALE
      IF(IDS-XSIGNF (1, XINTF (FUNCF (X, Y))) 70, 60, 70
   60 CONTINUE
C
C     ABNORMAL RETURN
C
      RETUAN
C
```

```
C       NORMAL RETURN
C
     70 IM=-IM
        RETURN
        END
C
C       ..........
C
C       DEFINITION OF THE FUNCTION TO BE FOLLOWED
C
        FUNCTION FUNC (X, Y)
        FUNC=(X*X+Y*Y+1.0)**2-4.0*X*X-1.1**4
        RETURN
        END
C
C       ..........
C
C       SUBROUTINE PEN-UP
C
        SUBROUTINE PENUP
        CALL EPUNCH (9)
        RETURN
        END
C
C       ..........
C
C       SUBROUTINE PEN-DOWN
C
        SUBROUTINE PENDWN
        CALL EPUNCH (10)
        RETURN
        END
C
C       ..........
C
C       SUBROUTINE EPUNCH
C
C       PURPOSE
C         OUTPUT THE PLOTTER CONTROL CODE TO EXTERNAL MEMORY (PAPER TAPE
C         THIS CASE) FOR OFF-LINE PLOTTING
C
C       USAGE
C         CALL EPUNCH (N)
C
```

```
C         DESCRIPTION OF PARAMETER
C           N  - CODE NUMBER AS GIVEN BELOW WITH THE MACHINE SPECIFIC
C                EXTERNAL CODE (OCTAL FORM) IN PARENTHESIS.
C                1=+X          (01)
C                2=+X, +Y      (05)
C                3=    +Y      (04)
C                4=-X, +Y      (06)
C                5=-X          (02)
C                6=-X, -Y      (12)
C                7=    -Y      (10)
C                8=+X, -Y      (11)
C                9=PEN UP      (20)
C               10=PEN DOWN    (40)
C
C         REMARKS
C           THIS ROUTINE IS MACHINE SPECIFIC, THE LINES BETWEEN M IN THE
C           FIRST COLUMN ARE PUNCH OUT INSTRUCTIONS IN MASH-3 LANGUAGE.
C           REFER TO THE INSTRUCTION MANUAL OF MASH-3 OKITAC-5090H.
C
          SUBROUTINE EPUNCH(N)
C
C         TEST WHETHER N IS A LEGAL CODE NUMBER
C
          IF(N) 40, 40, 10
       10 IF(N-10) 20, 20, 40
C
C         SET EXTERNAL CODE FOR PUNCHING
C
       20 GO TO (21, 22, 23, 24, 25, 26, 27, 28, 29, 30), N
B      21 SCODE=1
          GO TO 35
B      22 SCODE=5
          GO TO 35
B      23 SCODE=4
          GO TO 35
B      24 SCODE=6
          GO TO 35
B      25 SCODE=2
          GO TO 35
B      26 SCODE=12
          GO TO 35
B      27 SCODE=10
          GO TO 35
B      28 SCODE=11
```

```
          GO TO 35
B       29 SCODE=20
          GO TO 35
B       30 SCODE=40
        35 CONTINUE
M
            BOUT, 1, 22/ETCOM
            J/*+2
    ETCOM CONT1 (, , 1 , , SCODE)
M
          RETURN
C
C         ERROR MESSAGE
C
        40 WRITE OUTPUT TAPE 4, 50
        50 FORMAT (79H ILLEGAL CODE IS SUPPLIED TO SUBROUTINE EPUNCH, PROGRAM
         1 TERMINATED REGRETFULLY.)
          CALL EXIT
          END
```


参 考 文 献

CALCOMP Information Bulletin No. 139 (May 19, 1965)

OKITAC-5090H FORTRAN-H(2) システム説明書 (41.7.16)

OKITAC-5090H MASH-Ⅲ (40.8.10)

(昭和41年12月13日受付)