Integration of Acceleration Time History—IACC

The program IACC (**I**ntegration of **Acc**eleration Time History) is a subroutine subprogram that calculates the time history of velocity and displacement by integrating the given acceleration time history using the linear acceleration method, and also calculates the maximum velocity and maximum displacement.

IACC   **I**ntegration of **Acc**eleration Time History

Purpose

To compute the velocity and displacement time histories and their maximum values by integrating given acceleration time history using the linear acceleration method.

Usage

1   How to connect

`CALL IACC (DT, NN, DDY, DY, Y, ND, DYMAX, YMAX)`

Argument	Type	Parameter in calling program	Return Parameter
DT	R	Time interval (unit : sec)	Unchanged
NN	I	Total number of real data DDY,DY,Y	Unchanged
DDY	R 1-D array ND	Time history of input acceleration (unit : Gal)	Unchanged
DY	R 1-D array ND	No need to input here	Time history of output velocity (unit : cm/sec)
Y	R 1-D array ND	No need to input here	Time history of output displacement (unit : cm)
ND	I	Dimension size of DDY, DY, Y in calling program	Unchanged
DYMAX	R	No need to input here	Max value of velocity (unit : cm/sec)
YMAX	R	No need to input here	Max value of displacement (unit : cm)

(2   Necessary subroutines and function subprograms

None

Program List

```
C * * * * * * * * * * * * * * * * * * * * * * * * * * *       IACC   1
C      SUBROUTINE FOR INTEGRATION OF ACCELERATION TIME HISTORY  IACC   2
C * * * * * * * * * * * * * * * * * * * * * * * * * * *       IACC   3
C                                                             IACC   4
C                                          CODED BY Y.OHSAKI   IACC   5
C                                                             IACC   6
C      PURPOSE                                                IACC   7
C        TO INTEGRATE ACCELERATION TIME HISTORY BY MEANS OF THE LINEAR  IACC   8
C        ACCELERATION METHOD TO OBTAIN VELOCITY AND DISPLACEMENT  IACC   9
C        TIME HISTORIES AND THEIR MAXIMA                     IACC  10
C                                                             IACC  11
C      USAGE                                                  IACC  12
C        CALL IACC(DT,NN,DDY,DY,Y,ND,DYMAX,YMAX)              IACC  13
C                                                             IACC  14
C      DESCRIPTION OF ARGUMENTS                               IACC  15
C        DT     - TIME INCREMENT IN ACCELERATION TIME HISTORY IN SEC  IACC  16
C        NN     - TOTAL NUMBER OF DATA IN ACCELERATION TIME HISTORY  IACC  17
C        DDY(ND) - ACCLERATION TIME HISTORY IN GALS           IACC  18
C        DY(ND) - VELOCITY TIME HISTORY IN KINES              IACC  19
C        Y(ND)  - DISPLACEMENT TIME HISTORY IN CENTIMETERS    IACC  20
C        ND     - DIMENSION OF DDY,DY,Y IN CALLING PROGRAM    IACC  21
C        DYMAX  - MAX. VELOCITY IN KINES                      IACC  22
C        YMAX   - MAX. DISPLACEMENT IN CENTIMETERS            IACC  23
C                                                             IACC  24
C      SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED          IACC  25
C        NONE                                                 IACC  26
C                                                             IACC  27
       SUBROUTINE IACC(DT,NN,DDY,DY,Y,ND,DYMAX,YMAX)          IACC  28
C                                                             IACC  29
       DIMENSION DDY(ND),DY(ND),Y(ND)                         IACC  30
C                                                             IACC  31
       DYMAX=0.                                               IACC  32
       YMAX=0.                                                IACC  33
       DY(1)=0.                                               IACC  34
       Y(1)=0.                                                IACC  35
       DO 110 M=2,NN                                          IACC  36
       DY(M)=DY(M-1)+(DDY(M-1)+DDY(M))*DT/2.                  IACC  37
       Y(M)=Y(M-1)+DY(M-1)*DT+(DDY(M-1)/3.+DDY(M)/6.)*DT**2   IACC  38
       DYMAX=AMAX1(DYMAX,ABS(DY(M)))                          IACC  39
       YMAX=AMAX1(YMAX,ABS(Y(M)))                             IACC  40
  110 CONTINUE                                                IACC  41
       RETURN                                                 IACC  42
       END                                                    IACC  43
```

Example

Integrate the acceleration time history of the El Centro seismic wave (EQ.01) to compute the velocity and displacement time histories. The results are stored in the arrays *DY* and *Y,* respectively, and can be plotted as follows.

```
C
      DIMENSION DDY(800),DY(800),Y(800)
C
      READ(5,501) DT,NN,(DDY(M),M=1,NN)
      CALL IACC (DT,NN,DDY,DY,Y,800,DYMAX,YMAX)
      STOP
  501 FORMAT(T51,F10.0,I10/(8F10.0))
      END
```

Output：