Max. Velocity of Earthquake Motion by Kanai—VELK

The program VELK (Max. **Vel**ocity of Earthquake Motion by **K**anai) is a functional subprogram that calculates the maximum velocity of seismic motion on the bedrock, when the magnitude of the earthquake and the epicentral distance are specified.

VELK   Max. **Vel**ocity of Earthquake Motion by **K**anai

Purpose

To calculate the maximum velocity of the earthquake motion on the bedrock for given the magnitude of the earthquake and the epicentral distance.

Usage

1   How to connect
    `VELK(EM, R)    (unit: cm/sec)`

Argument	Type	Parameter in calling program	Return Parameter
EM	R	Magnitude of earthquake	Unchanged
R	R	Epicentral distance (unit : km)	Unchanged

(2   Necessary subroutines and function subprograms
        None

Calculation Method

The calculation is performed using the modified Kanai's equation shown below.

$$v_{\max} = 10^{0.61M - P\mathrm{Log}X - Q}$$

where $v_{\max}$: Maximum horizontal velocity (unit: cm/sec)

M : Magnitude of earthquake

X : Hypocentral distance (unit: km) $=\sqrt{R^2 + d^2}$

R : Epicentral distance (unit: km)

d : Focal depth (unit: km) $= 10^{0.353M - 1.435}$

$P = 1.66 + 3.60/X$

$Q = 0.631 + 1.83/X$

The focal depth d is assumed to be 1/2 of the equation by Iida, which gives the radius of the aftershock region.

Program List

```
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *    VELK   1
C     FUNCTION SUBPROGRAM FOR VELOCITY OF EARTHQUAKE MOTION BY KANAI  VELK   2
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *    VELK   3
C                                                                 VELK   4
C                                            CODED BY Y.OHSAKI     VELK   5
C                                                                 VELK   6
C     PURPOSE                                                     VELK   7
C       TO COMPUTE THE MAX. VELOCITY IN KINES OF EARTHQUAKE MOTION AT  VELK   8
C       BEDROCK BY MODIFIED KANAI'S FORMULA FOR GIVEN MAGNITUDE AND    VELK   9
C       EPICENTRAL DISTANCE. AS THE FOCAL DEPTH, HALF OF IIDA'S RADIUS VELK  10
C       OF THE AFTER-SHOCK REGION IS ASSUMED.                    VELK  11
C                                                                 VELK  12
C     USAGE                                                       VELK  13
C       VELK(EM,R) AS PRIMARY                                     VELK  14
C                                                                 VELK  15
C     DESCRIPTION OF ARGUMENTS                                    VELK  16
C       EM - MAGNITUDE                                            VELK  17
C       R  - EPICENTRAL DISTANCE IN KILOMETERS                    VELK  18
C                                                                 VELK  19
C     SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED               VELK  20
C       NONE                                                      VELK  21
C                                                                 VELK  22
      FUNCTION VELK(EM,R)                                         VELK  23
C                                                                 VELK  24
      D=10.**(0.353*EM-1.435)                                     VELK  25
      X=SQRT(R*R+D*D)                                             VELK  26
      P=1.66+3.60/X                                               VELK  27
      Q=0.631+1.83/X                                              VELK  28
      VELK=10.**(0.61*EM-P*ALOG10(X)-Q)                           VELK  29
      RETURN                                                      VELK  30
      END                                                         VELK  31
```

Example

Calculate the maximum velocity of seismic motion on the bedrock for an earthquake of magnitude 7.3 with an epicentral distance of 25.0 km.

```
      DATA  EM/7.3/,R/25.0/
C
      VMAX=VELK(EM,R)
      WRITE(6,601) EM,R,VMAX
      STOP
C
  601 FORMAT('M',TR3,F7.1//'R',TR3,F7.1,TR1,'(KM)'//
     *        'VMAX',F7.2,TR1,'(CM/SEC)')
      END
```

Output:

```
      M       7.3

      R      25.0 (KM)

      VMAX  14.37 (CM/SEC)
```