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User Manual

Section 1 Program Setup

Step 1

Download all the source codes in the GitHub repository subfolder, src, into a working folder in your computer.

Step 2

Incorporate the user-defined Mavroeidis&Papageorgiou wavelets into MATLAB.

1. Launch MATLAB in your computer.
2. Make the working folder in Step 1 the "current folder" in MATLAB.
3. In MATLAB command window, run the following command:

   ```
   wavemngr('add', 'MavPap', 'mp', 4, {'1-90 2-0 2-90 3-0 3-90 4-0 4-90',...
   'string'}, 'mavpap', [-pi, pi])
   ```

4. In MATLAB command window, run the following command:

   ```
   wavemngr('read')
   ```

   to confirm that "MavPap" has been successfully added as one of the available wavelet families in MATLAB.

Step 3

Download the repository subfolder, PiPVsurf_database, with its content to your computer.

Step 4

1. Follow the organization and the content in the repository subfolder, Example/Input_GRM, to prepare your ground motion records in PEER Strong Motion Database format (i.e., *.AT2 files). Each record consists of three orthogonal components, two horizontal and one vertical. (Note: the vertical component is not used in PulseDetect3D currently.)

2. Provide a list of all the input ground motion components in a txt file, like List_GRM.txt in the repository subfolder, Example/Input_GRM. In this list, the three components of each record appear in the sequence of the 1st horizontal component, the 2nd horizontal component, and the vertical component.

Step 5

Edit the basic parameters at the beginning of the file, main_PulseDetect3D_2022.m, in your working folder according to your local settings and preference.

Section 2 Output

After executing main_PulseDetect3D_2022.m in MATLAB, the program should generate the following outputs.

Output 1

A txt file containing the parameters of the pulses identified in the input ground motions, like Pulse_Parameters.txt in the repository subfolder, Example/Output. In this file, each row contains

Field #	Content
1	Name of ground motion record
2	Orientation in terms of the rotation angle (in deg.) from the 1st horizontal component toward the 2nd horizontal component of the ground motion record as specified in the list provided in Section 1 Step 4
3	Peak ground velocity (PGV) in cm/s
4	Selection criterion for the pulse candidate (1–peak velocity closest to PGV, 10–the largest CWT coefficient, 11–both lead to identical result)
5	Pulse waveform
6	Pulse period in sec
7	Pulse envelope amplitude in cm/s
8	Peak velocity of pulse in cm/s
9	Pulse indicator according to Shahi&Baker (2014)
10	Pulse arrival (Early or Late) according to Shahi&Baker (2014)
11	Pulse indicator according to Chang et al.(2016) and Zhai et al. (2013)
12	Pulse arrival (Early or Late) according to Chang et al.(2016) and Zhai et al. (2013)
13	Pulse indicator according to Kardoutsou et al. (2017)

Output 2

A folder for each ground motion record that contains the following items:

1. Subfolders, each corresponding to one horizontal orientation in which pulse is identified, containing the rotated ground acceleration and velocity data files as well as the pulse(s) selected according to different criteria (i.e., 1–peak velocity closest to PGV, 10–the largest CWT coefficient, 11–both lead to identical result);

2. Data files, each of which contains the pseudo-velocity response spectrum surface data corresponding to one horizontal orientation considered, if flag_savePV has been set as 1 in the program file, main_PulseDetect3D_2022.m.