Numerical characteristics of surface waves on 3D6C records

Xinming Qiu, Yun Wang, Lixia Sun

Multi-Wave Multi-Component Group, China University of Geosciences, Beijing

We simulate six-component (6C) seismic waves by the 3-dimensional (3D) staggered-grid finite-difference method to study rotational characteristics of surface waves.

Parameters of our finite-difference method
Time step size: 0.1 ms
Spatial cell size: 0.1 m*0.1 m
Free surface

Table 1. The parameters of our model

Thickness (m)	Vp (m/s)	Vs (m/s)	Density (kg/m^3)
10	800	200	2000
-	1200	600	2000

Results

Vertical Point Source

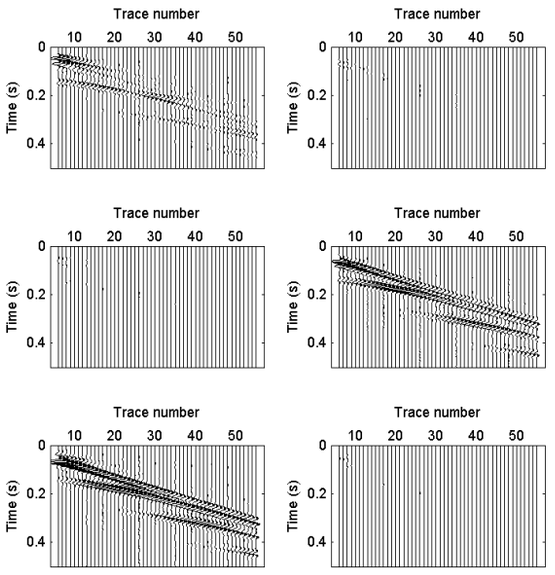

Fig.1. Synthetic six-component seismic data by a vertical point source. The data of the first column are the translational-components: X component, Y component, and Z component. The data of the second column are the rotational-components: Rx component, Ry component, and Rz component.

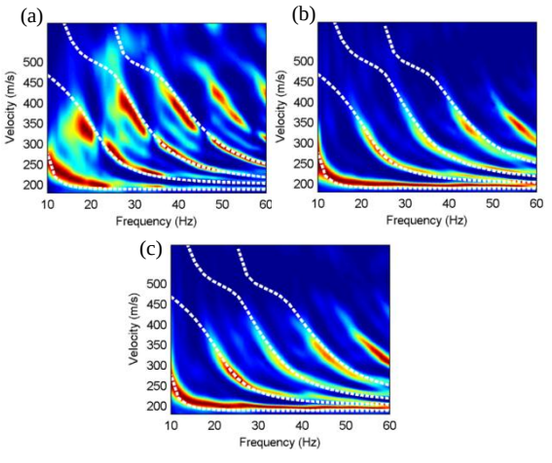

Fig.2. Frequency-velocity spectra of (a) X component, (b) Z component, and (c) Ry component, where the white dotted lines represent the theoretical dispersion curves of Rayleigh waves.

Transverse Point Source

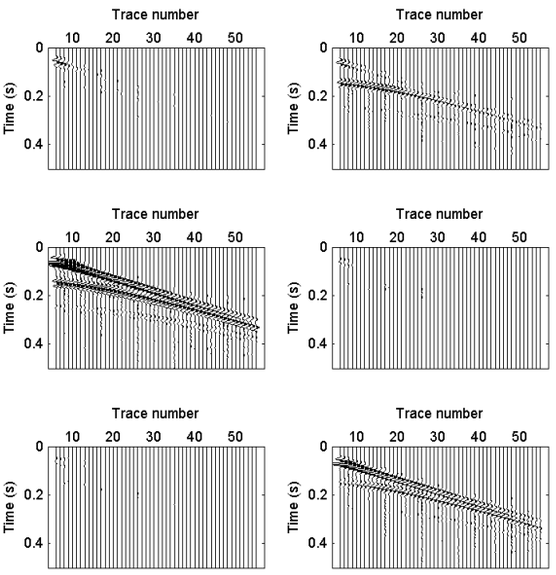

Fig.3. Synthetic six-component seismic data by a transverse point source. The data of the first column are the translational-components: X component, Y component, and Z component. The data of the second column are the rotational-components: Rx component, Ry component, and Rz component.

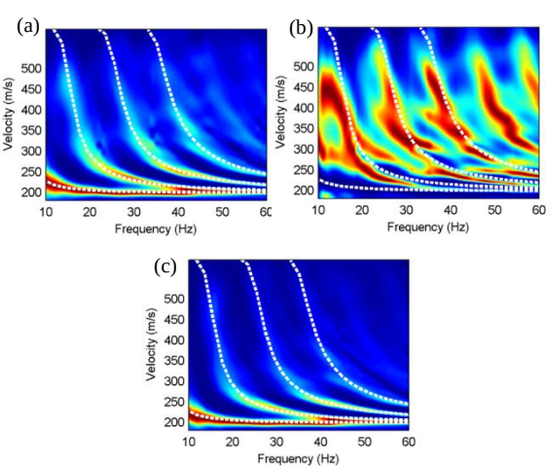

Fig.4. Frequency-velocity spectra of (a) Y component, (b) Rx component, and (c) Rz component, where the white dotted lines represent the theoretical dispersion curves of Love waves.

Conclusions

1. The strong energies are Rayleigh waves on the X component, Z component, and Ry component when excited by a vertical point source, while Love waves are dominant on the Y component, Rx component, and Rz component when excited by a transverse point source.
2. Rotational components have different dispersion characteristics from the translational components which will be beneficial to estimate the near-surface S-wave velocities.

Contact Information Xinming Qiu *MWMC Group, China University of Geosciences, Beijing*
E-mail:xinming_q@foxmail.com