Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)


SSS27-P06 Room:Poster Time:April 29 18:15-19:30

# Modeling inclined cracks in a 2-D finite difference grid

NASUNO, Arata[1] ; KAWAHARA, Jun[1*] ; SHIINA, Takahiro[2] ; OKAMOTO, Taro[3]

[1]Ibaraki University, [2]Tohoku University, [3]Tokyo Institute of Technology

Seismic scattering due to cracks are often numerically simulated using a boundary integral equation method (BIEM), a finite element method, or a finite difference method (FDM). Among others, the FDM has a great advantage in tractability, though having a limitation that it can treat rectangular grids only. Using the rotated staggered grid that they developed, Saenger et al. (2000, Wave Motion) modeled a crack or cavity as a gather of grid points with zero elastic constants. In contrast, Suzuki et al. (2006, 2013, Earth Planets Space) modeled a 2-D empty crack as a linear array of grid points with zero traction on the basis of a standard staggered grid (Virieux, 1984, 1986, Geophysics). Using this method, these authors successfully simulated seismic wave scattering due to cracks. However, they only treated cracks parallel to grid lines.

Here we extended the method of Suzuki et al. (2006) for modeling cracks with zero antiplane shear traction to the case of cracks inclined with respect to grid lines. Using the idea of the staircase approximation to irregular free surface (Ohminato and Chouet, 1997, Bull. Seis. Soc. Am.), we modeled an inclined crack as staircase-like arrayed grid points with zero antiplane shear traction within a staggered grid. We then simulated a plane harmonic SH wave obliquely incident on the crack until the resultant oscillation of the crack became stationary. We then measured the amplitude of displacement discontinuity along the crack. We also calculated the same displacement discontinuity using a frequency-domain BIEM (Murai et al., 1995, Geophys. J. Int.). It was confirmed that the both results were consistent, irrespective of the crack inclination angle, if the grid spacing was much smaller than the crack length and hence the staircase-shaped crack plane was sufficiently smooth. This implies the validity of the present method of modeling inclined cracks.

Acknowledgments: For the BIEM calculations, we used a code of Dr. Yoshio Murai (Hokkaido University), and used the computer systems of the Earthquake and Volcano Information Center of the Earthquake Research Institute, the University of Tokyo.

Keywords: finite difference method, crack, SH wave