Computation of synthetic seismograms in a fluid-solid medium using a stable and optimally accurate finite-difference scheme

Hiromitsu Mizutani[1]; Robert J. Geller[2]

[1] Graduate school of science, Univ. of Tokyo; [2] Earth and Planetary Science, Tokyo Univ

We have previously derived stable and optimally accurate finite-difference schemes for computing synthetic seismograms in solid media (ASC, 2008).

In this presentation, we extend the result to a fluid-solid medium, and derive a stable and optimally accurate formulation. Our scheme is superior to the previous schemes in terms of accuracy and stability for such media (e.g. Okamoto and Takenaka, 2005, Robertsson et al, 1995 and Saenger et al. 2000).

In our formulation, we use a weak form formulation and the fluid-solid boundary condition is expressed as surface integrals. And based on the previously derived general stability criterion, we construct non-negative definite stiffness matrix for fluid-solid medium,

Our scheme can handle solid and fluid region by cell-based formulation. We show a simple numerical example in figure. We show the wave field of 2-D P-SV problems for homogeneous elastic medium with open crack and fluid-filled crack. We show two wavefields for different time steps in the top and bottom row, and from left to right, the vertical and horizontal wavefield for the open crack case and those for the fluid-filled crack case. In this example, we show examples for a linear crack, but the extention to arbitrary shaped crack is straightforward.