FDTD MODELLING OF SEISMIC WAVE PROPAGATION IN POROUS MEDIA

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We have developed a discrete representation of a strong material heterogeneity in the poroelastic medium and poroviscoelastic medium in the low-frequency regime. The representation makes it possible to model an arbitrary shape and position of an interface with sub-cell resolution in a uniform spatial grid. The computational efficiency of the finite-difference grid is unchanged compared to the scheme for a homogeneous and smoothly heterogeneous medium because the number of operations for updating stress-tensor, fluid pressure and particle velocities is the same. The only difference is that it is necessary to evaluate averaged grid material parameters once before the finite-difference simulation itself. The developed representation extends the possibilities of the finite-difference modelling of seismic wave propagation in the poroelastic medium.

We numerically demonstrate accuracy and sub-cell resolution of our modelling on a variety of canonical models by comparing the finite-difference solutions with analytical solutions and also an independent numerical method. We also present preliminary results of investigating effects of presence of a porous water-saturated sediment layer (described by a depth of a water table, porosity and permeability) in local surface sedimentary basins on a set of earthquake ground motion characteristics.