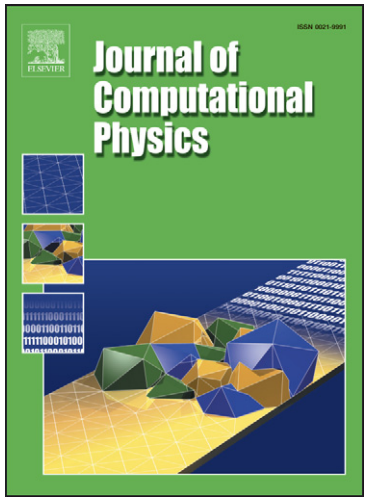

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A pseudo-spectral method for the simulation of poro-elastic seismic wave propagation in 2D polar coordinates using domain decomposition

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Abstract

We present a novel numerical approach for the comprehensive, flexible, and accurate simulation of poro-elastic wave propagation in 2D polar coordinates. An important application of this method and its extensions will be the modeling of complex seismic wave propagation phenomena in fluid-filled boreholes, which represents a major, and as of yet largely unresolved, computational problem in exploration geophysics. In view of this, we consider a numerical mesh, which can be arbitrarily heterogeneous, consisting of two or more concentric rings representing the fluid in the center and the surrounding porous medium. The spatial discretization is based on a Chebyshev expansion in the radial direction and a Fourier expansion in the azimuthal direction and a Runge-Kutta integration scheme for the time evolution. A domain decomposition method is used to match the fluid-solid boundary conditions based on the method of characteristics. This multi-domain approach allows for significant reductions of the number of grid points in the azimuthal direction for

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