Time domain modeling of wave propagation in 2D acoustic / porous media

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Abstract. Semi-analytical and numerical methods are developed to investigate the wave propagation in 2D heterogeneous fluid / poroelastic media. Wave propagation is described by the usual acoustics equations (in the fluid medium) and by the low-frequency Biot's equations (in the porous medium). Interface conditions are introduced to model various hydraulic contacts between the two media: open pores, sealed pores, and imperfect pores.
Cartesian grid numerical methods previously developed in porous heterogeneous media [1] are adapted to the present context: a fourth-order ADER scheme with Strang splitting for time-marching; a space-time mesh-refinement to capture the slow compressional wave predicted by Biot's theory; and an immersed interface method to discretize the interface conditions and to introduce a subcell resolution.
The semi-analytical method derived from [2] aims at computing the Green's functions in the fluid and the poroelastic media to evaluate displacements and velocity fields for reflected and transmitted waves.
Numerical experiments and comparisons between the two methods are proposed for realistic configurations and different types of interface conditions, demonstrating the accuracy of both approaches.

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References

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