Summary: This study presents a new formulation of smoothed particle finite element method (SPFEM) for dynamic problems in two-phase saturated porous media. A node integration method is used for both solid and water phases, which helps stabilize the coupled formulation when low-order triangle elements are used. Two different time integration schemes (i.e. explicit velocity Verlet and semi-implicit fractional step methods) are used to solve the coupled SPFEM formulations. In particular, a novel weakly-compressible fractional step algorithm is proposed, the key virtue of which is its capability to simulate high-frequency dynamic wave propagation in the porous media. The proposed coupled SPFEM is validated by comparing the numerical results with the analytical solution of two poroelastic examples, focusing on 1D wave propagation and 1D consolidation problems. Three more numerical tests are presented to further validate the proposed coupled SPFEM in simulating 2D wave propagation, self-weights slumping block and seepage flow induced progressive failure of embankment, and a very good agreement with the numerical results reported in the literature is obtained.

MSC:

76-XX Fluid mechanics
74-XX Mechanics of deformable solids

Keywords:
smoothed particle finite element method; node integration; fractional step method; porous media; large deformation; dynamics

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References:


Rodríguez, J. M.; Carbonell, J. M.; Cante, J. C.; Oliver, J., Continuous chip formation in metal cutting processes using the


[71] Verruijt, A., An Introduction To Soil Dynamics (2010), Springer Netherlands


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