Numerical Estimation of Effective Properties of Rocks Using 3D Tomographic Images

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This paper is concerned with numerical considerations of effective transport and effective mechanical properties of rocks. We derive these properties directly from rock microstructure using 3D tomographic images. Permeability values were estimated through Lattice-Boltzmann (LB) flow simulations. The effective shear and P-wave modulus is derived by dynamic wave propagation simulations. We apply a displacement-stress rotated staggered finite-difference (FD) grid technique to solve the elastodynamic wave equation. An accurate approximation of a Newtonian fluid is implemented in this technique by using a generalized Maxwell body. We give a practical description how to use this approach. An additional accuracy condition for simulations with viscous fluid infill is described. This condition requires that the spatial grid size is several times smaller than the thickness of the dynamic viscous boundary layer adjacent to the fluid/solid interface.