

Porosity effects on macroscopic elasticity investigated by buffered multiple grid FEM model

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It has been considered that porosity affects significantly on macroscopic elasticity of porous objects. This property has been investigated by many empirical approaches assuming macroscopic isotropic elasticity. Alternatively many finite elements methods (FEM) have been conducted as well to clarify the pore effect. In the present study, I newly developed the multi-grid finite element method model for investigating the pore effect much more precisely than any other existing approach. The most pronounced feature of the present model is to introduce buffer layers inside porous objects. The buffer layer is very effective to neutralize the singularity caused by the boundary discontinuity. I analyzed both 2D and 3D models for pore effect systematically with changing pore aspect ratio. Among many new findings, the most pronounced discovery is that the acoustic velocities decrease in proportion with porosity for earth constituting rock with needle type pores inside.