

LOCKING-FREE FINITE ELEMENT METHODS FOR POROELASTICITY

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ABSTRACT. We propose a new formulation along with a finite element scheme for the approximation of the interaction between fluid motion and linear mechanical response of a porous medium, known as Biot's consolidation problem. The system is recast in terms of displacement, pressure, and volumetric stress, and both continuous and discrete formulations are analyzed as compact perturbations of invertible problems employing a Fredholm argument. Numerical results indicate the satisfactory performance and competitive accuracy of the introduced schemes.

Keywords: Poroelasticity; Finite element method; Volumetric stress formulation; Compact perturbation; Fredholm alternative; Error estimates.

Mathematics Subject Classifications (2010): 65N30; 76S05; 74F10; 65N15.

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