FSM1S_11044

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Bifurcation of the P2 Wave and its Influence on Fluid-Induced Micro Earthquakes in Porous Rocks: Long Wave Asymptotics of the Biot Model

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The behavior of the Biot wave in a fluid-saturated porous medium is investigated by asymptotic methods. It is proven that the P2 wave possesses a bifurcation: it is fully attenuated if its wave number is smaller than critical value and it becomes propagatory with wave numbers bigger than critical one. Although the long wavelength P2 modes are not propagatory and have a diffusive behavior, they influence significantly the pore pressure distribution in a medium. One knows that an injection of the borehole fluids into surrounding rocks often results in micro earthquakes if the value of the pore pressure exceeds some threshold. The solution of the Biot system with relevant boundary conditions at the borehole is constructed and applied to the description of the seismic cloud and to the evaluation of the critical values of the pore pressure. Moreover, this approach allows one to estimate a permeability of natural rocks.

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