ANALYSIS OF SEISMIC WAVE PROPAGATION THROUGH SUBSURFACE MEDIA

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Abstract

Fluid saturation in subsurface media, substantially influence the characteristics of seismic waves during its propagation through deformable saturated porous media. The propagating wave apply stress on the media which results into pressure gradient at multiples scales. This scenario results into fluid flow and ultimately into wave attenuation and dispersion. Particularly, partial saturation and fluids of different nature significantly cause wave attenuation and dispersion due to well-known phenomenon of wave-induced fluid flow at different frequencies and scales. Especially, fluid flow at scale greater then microscopic scale but much less than macroscopic scale (mesoscopic scale) significantly influence wave propagation characteristics at frequencies below 1 kHz. For better understanding of wave propagation through fluid saturated subsurface rocks, an improvement in measuring attenuation and dispersion characteristics from seismic data can assist in measuring hydraulic properties of subsurface rocks. Number of theoretical models were proposed to understand wave propagation characteristics through fluid saturated deformable porous media. Some of these theoretical models were numerically validated by providing the solution of wave equations. Seismic numerical modeling technique provide most suitable way for the simulation of wave propagation through subsurface rocks. Also, it play an essential role in seismic interpretation, seismic inversion and in evaluating and designing a seismic survey. Different approaches were proposed for numerical modeling in which the solution of wave equations were given. In current study, a 2D finite difference modeling method is applied for the estimation of wave attenuation and dispersion in a subsurface heterogeneous media. The outcomes of our research reveals that, this study will enhance our understandings about wave propagation through subsurface media and will also assist in detecting and discriminating subsurface materials.