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综合评述

多孔介质的流体机制模型及其频散机理

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摘要 当声波或弹性波在流体饱和多孔介质中传播时，孔隙或裂缝受其影响发生闭合或张开，流体产生相对运动，致使多孔隙岩石的宏观物理性质发生变化，从而引起弹性波传播速度的改变、能量的耗散和振幅的衰减。基于双相介质理论提出的Gassmann方程、Biot理论、喷流机制、BISQ模型和斑块饱和模型等岩石物理机制模型，以不同的流体流动机制描述了多孔介质中弹性波传播的动态耦合机理、耦合程度和耦合结果。许多岩石物理机制模型都试图模拟和解释岩石中速度频散和衰减的起因。根据现有各种机制模型的高限、低限频率和特征（弛豫）频率，可以粗略地计算出衰减和频散的影响。随着地震岩石物理学研究的深入与发展，人们对弹性波速度频散和衰减与岩石物理性质及本征条件之间关系的认识必将不断深化。

关键词 Gassmann方程；Biot理论；喷流机制；BISQ模型；斑块饱和模型；频散机理

Fluid mechanism models and their velocity dispersions in porous media

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Abstract Pores or cracks in a fluid saturated porous medium are subject to close or open when acoustic waves or elastic waves propagate through it.The resulted relative fluid movement gives rise to the changes of macroscopic physical properties of the porous medium in velocity,energy dissipation,and amplitude attenuation.Based on two phase medium theory,people have already proposed several rock physical mechanism models such as Gassmann s equation,Biot s theory,squirt or local flow mechanism,BISQ model,and patchy saturation model.These models define the dynamic coupling mechanism,coupling degree and coupling results in different fluid flow mechanism for the elastic wave propagation in the porous medium.Many of the rock physical mechanism models try to simulate and explain the cause of velocity dissipation and amplitude attenuation in rocks.The effects of the dissipation and attenuation can be estimated roughly according to the high frequency limit,low frequency limit,and characteristic frequency (relaxation frequency) defined by these mechanism models.Along with thorough research and development of seismic rock physics,the understanding to the relations between elastic wave velocity dissipation and amplitude attenuation with the rock physical property as well as the inherent condition will certainly deepen unceasingly.

Key words Gassmann s equation;Biot s theory;squirt or local flow mechanism;BISQ model;patchy saturation model;velocity dissipation

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