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中国高校优秀科技期刊

孔祥伟,林元华,邱伊婕,董龙.虚拟质量力对酸性气体-钻井液两相流波速的影响[J].计算力学学报,2014,31(5):622~627

虚拟质量力对酸性气体-钻井液两相流波速的影响

Influence of virtual mass force on two-phase wave velocity in acid gas and mud

投稿时间:2013-04-09 修订日期:2013-07-23

DOI: 10.7511/jslx201405013

中文关键词: 虚拟质量力 酸性气体 压力波波速 钻井液 气液两相

英文关键词: virtual mass force acid gas pressure wave velocity drilling mud gas and liquid two-phase

基金项目:国家自然科学基金(51074135, 51274170);四川省科技创新团队(2011JTD0034)资助项目.

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中文摘要:

基于两流体模型、酸性气体和钻井液状态方程,考虑酸性气体与钻井液相间虚拟质量力、粘性剪切力、相间动量交换及狭义相间阻力等条件,建立酸性气体与钻井液两相中压力波传播速度的数学模型,依据小扰动原理,对波速模型求解,得到关于波数K的波速方程。结果表明,在一定范围内,随空隙率、频率的增大,虚拟质量力对波速的影响显著增强;在高空隙率下,压强增大,虚拟质量力对波速的影响减弱;增大流体的密度或不可压缩性,均可使两相压力波速增大;延长气液交换时间或减小波动频率使相间有足够时间进行动量交换,两相压力波波速随之减小。

英文摘要:

With consideration of interphase virtual mass force,viscous shearing force,narrow interphase momentum exchange,interphae resistance,a mathematical model for predicting the propagation velocity of pressure wave in two-phase flow of acid gas and drilling fluid was proposed based on the two-fluid model and equation of state for acid gas and drilling fluid.The p mathematical model was solved by using the small perturbation theory,and a model concerning wave number K was derived to calculate the wave velocity.Calculation results indicate that the influence of virtual mass force becomes more prominent with the increase of angular frequency and void fraction within a certain range.At high void fraction,the influence of virtual mass force appears a weakening trend with the increase of pressure.Both the increase of density and incompressibility of two-phase fluid contribute to the increase of pressure wave velocity.It is the prolongation of gas-liquid exchange time and decrease of fluctuation frequency that supply sufficient time for momentum exchange,and slow down the pressure wave velocity accordingly.

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