APPROXIMATION OF ELASTIC VELOCITY-PRESSURE RELATION IN ROCKS

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The nonlinear dependency of elastic velocities in rocks on high confining pressures is routinely observed in high pressure ultrasonic experiments on rock samples with different mineral composition or occurrence. This well-known relationship mostly reflects the deformation of cracks and pores either by the lithostatic pressure or during the confining load in laboratory experiments. In this work we have considered the velocity-pressure relationship, aiming to obtain the widely used approximation formula $v(p) = V_0 + Bp - De^{-kp}$ with four parameters, that are usually found as a result of the approximation. It has been shown that under condition of low concentrations of non-interacting pores and cracks and isotropic elasticity of mineral matrix, whose elastic constants weakly depend on pressure and with an assumption of constant effective aspect ratio, all four parameters can be expressed through the elastic constants of rock matrix, porosity, crack densities and crack orientations. The obtained results were tested on published data on elastic velocities and on the *P*-wave velocity data from measurements on two anisotropic rock spheres. Key assumptions of our derivation approach as well as the application of the obtained formulas have been discussed.