ON ESTIMATION OF CRITICAL LOADS FOR ROCKS UNDERGOING LARGE DEFORMATIONS IN MULTIAXIAL COMPRESSION: 3-D APPROACH

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The wide-spread structure of rocks is a layered one. Therewith, different cases of the interface adhesion breakdown in rocks (such as cracks, separations onto layers, delaminations, exfoliations, slippage zones and similar imperfections) can arise. One of the fracture mechanisms for such rocks undergoing finite (large) deformations in multiaxial compression is fracture due to the loss of stability in the internal structure – the internal instability. The problem of the internal instability is solved within the scope of the exact statement based on the application of the model of piecewise-homogeneous medium and equations of the 3-D stability theory, which allows eliminating the restrictions imposed by utilisation the approximate theories. The estimation was suggested to find the upper and the lower bounds for critical loads for laminated structures in compression along the interlaminar defects using the results for perfectly-connected and sliding layers. Substantiation of the bounds is based on the general principles of mechanics on the influence of release from a part of connections on value of critical loads for the mechanical system. Values of critical loads are obtained for various real kinds of orthotropic compressible and incompressible layers, which can be linear or non-linear elastic. Numerical results for rocks undergoing biaxial compression (non-axisymmetrical problem) or uniaxial compression show that proposed bounds give very good estimation for the particular cases of rocks.