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Study of internal stresses in rock massif within the framework of elastic layered block models with inclusions of the hierarchical structure of the L-rank.

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In recent years, new models of continuum mechanics, generalizing the classical theory of elasticity, have been intensively developed. These models are used to describe composite and statistically heterogeneous media, new structural materials, as well as in complex massifs in mine conditions. The paper presents an algorithm for the propagation of longitudinal acoustic waves in the framework of active well monitoring of elastic layered block media with inclusions of hierarchical type of L-th rank. Relations for internal stresses and strains for each hierarchical rank are obtained, which constitute the non local theory of elasticity. The essential differences between the non local theory of elasticity and the classical one and the connection between them are investigated. A characteristic feature of the theory of media with a hierarchical structure is the presence of scale parameters in explicit or implicit form. This work focuses on the study of the effects of non locality and internal degrees of freedom, reflected in internal stresses, which are not described by the classical theory of elasticity and which can be potential precursors of the development of a catastrophic process in a rock massif. Thanks to the use of a model of a layered block medium with hierarchical inclusions, it is possible, using borehole acoustic monitoring, to determine the position of the highest values of internal stresses and, with less effort, to implement the method of unloading the rock massif. If it is necessary to conduct short-term predictive monitoring of geodynamic regions and determine a more accurate position of the source of a dynamic phenomenon using borehole active acoustic observations, it is necessary to use the values of the tensor of internal hierarchical stresses as a monitored parameter.