

Temporal Characterization of Rock Dynamic Destruction

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ABSTRACT

The phenomenon of material strength increasing under dynamic loadings has been widely observed in publications dedicated to rocks [1]. The essence of this effect lies in the fact that material is able to withstand the action of a pulse with amplitude bigger than its static strength if loading rate is high enough. Moreover, increasing of loading rate leads to raising of ultimate stress magnitude.

Studying of material strength parameters in laboratory conditions includes measuring of quasi-static mechanical characteristics, for example by servo-drive machines, and dynamic ones by standard test scheme modified by split Hopkinson pressure bar technique. Application of such loading method makes it possible to carry out experiments up to $10^2 - 10^4 \text{ s}^{-1}$ strain rates. Investigations under higher loading rates may be done with the help of spall or plane wave technique.

To analyse united set of static and dynamic strength properties of given rock material data incubation time criterion have been used [2, 3, 4]. According this approach destruction of sample under highrate loadings is controlled by incubation time - material constant characterizing the damage development on microstructural level. In this work authors have been estimated incubation times for the set of rocks like sandstones, limestones, granites and others. Obtained values have been used to construct theoretical curves describing dependence of studied material strength on load parameters. Influence of additional effects like temperature and saturation variation, prestress conditions and multiaxial load on magnitude of incubation time have been considered.

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