Prediction of the fracture of metals during static and dynamic loading based on the theory of critical distances

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Development of the method for assessing the strength of engineering structures, considering the effects of the non-locality fracture in the area of stress concentrators, under different loading regime is one of the major scientific interests. The theory of critical distances (TCD) is one of the most promising approaches to the prediction of material fracture, in which the stress concentration effect is taken into account. The fundamental idea of the TCD was first proposed by Peterson [1] and further developed by such authors as Novozhilov [2], Whitney, and Nuismer [3]. It was also proved that the TCD can be used to predict the static strength of the notched brittle and quasi-brittle material [4] as well as of ductile metallic material under uniaxial and multiaxial static loading. The idea of the TCD to use one characteristic material length parameter, so-called critical distance \( L \), and linear-elastic analyzes to predict both brittle fracture and fatigue strength. This work presents a design methodology suitable for estimating lifetime under conditions of static and dynamic tensile loading on the cylindrical un-notched specimens and specimens with stress concentrators.