北京建筑大学
BEIJING UNIVERSITY OF CIVIL
ENGINEERING AND ARCHITECTURE

Review

of the member of the dissertation council for the dissertation of Igusheva Liudmila Aleksandrovna on the topic: «Effect of External Force and Temperature Influences on Dynamic Material Fracture», submitted for the degree of candidate of Physico-Mathematical Sciences in scientific speciality 1.1.8. Solid Mechanics.

As the main construction materials, rock, cement and concrete are widely used in civil engineering, mining, hydrotechnical engineering, and other industrial areas. The mechanical properties of these quasi-brittle materials under dynamic loading are different form that under static loading. The strength and toughness of these materials demonstrate loading time, temperature and hydrostatic pressure dependence. hence the study on the mechanism underlying these properties and the mathematical description are actual. Therefore, the dissertation titled «Effect of External Force and Temperature Influences on Dynamic Material Fracture» has essential scientific and technical significance.

In this dissertation, the structural-temporal approach based on incubation time was used to qualitatively and quantitatively consider the influence of loading history, hydrostatic pressure and preliminary temperature treatment on fracture toughness and strength of cement mortars and rocks. The advantage of this approach is that the incubation time of fracture of materials under dynamic loading is a material property that does not depend on the loading history and the sample geometry. This endowes this approach an universal feature. The main scientific novelties are as follows：

1.A model of wave propagation in rods located in an elastic environment is constructed, and the rod fracture in an elastic environment based on the the structural-temporal approach is described.The possibility of increasing the initial pulse amplitude and the rod fracture as a result of spall as a wave passes in the forward direction along the rod were shown. The range of optimal impact durations when the rod is broken down with a minimum loading pulse amplitude was found. External influence frequencies at which the rod can bear maximum loads were identified.

2.The dependence of incubation time on the pretreatment temperature, hydrostatic pressure was found.

3.Based on the structural-temporal approach, the universal description of dependences of strength and fracture toughness of rocks on loading rate, hydrostatic pressure levels, the pretreatment temperature is given. The scientific results obtained in this work contribute to the methods development for analyzing the materials strength exposed to various external influences, and can find practical applications in sovling actual problems in relatedin civil engineering, mining, hydrotechnical engineering etc.

Considering the above, I believe that Igusheva`s dissertation on the topic: «Effect of External Force and Temperature Influences on Dynamic Material Fracture» meets the requirements of speciality 1.1.8. Solid Mechanics.

No violations of paragraphs 9 and 11 of the Order No.11181/1 as of November 19, 2021 "On the Procedure for Awarding Academic Degrees at St. Petersburg State University" have been detected.

The dissertation meets the criteria of dissertations for the academic degree of candidate of Physico-Mathematical Sciences, established by the specified Order. The dissertation is recommended for the defense at St. Petersburg State University.

Some additional suggestions for improving the dissertation are as follows:

1.One section summarizing the existing unsolved scientific prolems at the end of the Chapter I is suggested for enhancing the novelty of the dissertation;

2.The physical mechanism of the dependence of incubation time on the internal structural parameters, loading rate, hydrostatic pressure levels, the pretreatment temperature is suggested to reveal deeply;

3.The physical meaning of structural-temporal criterion is suggested to reveal.

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