北京建筑大学
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ENGINEERING AND ARCHITECTURE

Review

of the member of the dissertation council for the dissertation of N.A.Kazarinov on the topic: «Space and Time Discreteness of Dynamic Fracture and Related Effects», submitted for the degree of Doctor of Physico-Mathematical Sciences in scientific speciality 1.1.8. Solid Mechanics.

Any solid matter has internal structure which affects the mechanical properties significantly. Hence the discreteness is the intrinsic nature of solid matter. On the other hand, mechanical properties of solid materials under dynamic loading are different from that under static loading. The deformation and fracture of materials under intense dynamic loading remains one of the most important problems of modern scientific and engineering practice. Therefore, the dissertation titled «Space and Time Discreteness of Dynamic Fracture and Related Effects» has essential scientific and technical significance.

In this dissertation, the discret model of solid based on linear oscillators and the concept of incubation time was used to study the dynamic deformation and fracture of solid matters. This approach is very effective in revealing many important mechanical features of solid under intensive dynamic loading. The main scientific novelties are as follows:

1.Based on the discovered analogy between the processes of dynamic fracture and the failure of a linear oscillator, dynamic fracture model based on linear oscillators has been constructed and was used to describe experimental results and to study key dynamic fracture effects.

2.The underlying mechanism of effects of crack velocity oscillations and variation of the stress intensity factor values have been revealed. And it is found that the stress intensity factor – crack velocity relation was shown to be defined by the type of the applied load.

3.New numerical and experimental approaches have been developed to analyze qualitatively the experimentally observed dynamic fragmentation, the strength of materials under quasi-static, cyclic and dynamic types of loads.

4.The effect of fracture in periodic structures in case of sudden unloading has been discovered and studied.

5.The method based on artificial neural networks has been developed to accelerate calculations and to overcome numerical instabilities in impact problems of breaking through obstacles.

Considering the above, I believe that Kazarinov`s dissertation on the topic: «Space and Time Discreteness of Dynamic Fracture and Related Effects» 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 doctor 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.For solid materials under intensive dynamic loading the plastic deformation is evident, therefore the oscillator model should be nonlinear.

2.According to academician M.Sadovsky, rock has complex hierarchical internal structure, the upscaling in deformation and fracture is a important effect.

3.What is the applicable conditions of the method based on artificial neural networks?

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Date: October 25, 2024

PKN 33-06-1028
от 05.11.2024

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