PNRPU Mechanics Bulletin

Issue 1, 2018, Pages 110-120

Applied grinding model of a solid particle with a simple shape on impact with a hard surface(Article)(Открытый доступ)

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Краткое описание

The complexity of phenomena caused by grinding and fracturing of solid particles makes it difficult to provide the theoretical description of this process. In this case, it is important to establish relationships between the parameters that determine the characteristics of the grinding process, determine the degree of their influence on each other, create and analyze the grinding process model taking into account crusher's parameters, physical and mechanical properties of the material. Consequently, the improvement of formal calculation methods and justification of rational parameters of crushers ensure the effectiveness of their use during operation. By analyzing real materials' state, a large group of scientists have created a number of theories explaining fracture conditions and mechanisms in solid materials. However, it is quite difficult to apply the existing theories for calculation of grinding processes. Therefore, there is a need to develop a new simple and convenient theory for practical application. Authors offer a new method aimed at theoretical description of a material's fracture. Based on the simplified energy hypothesis and applied technical theory of wave spreading in elastic continuous medium, we have obtained a new refined solution of the fundamental dynamic mechanical problem of an elastically deformable rigid body about a longitudinal collision of a beam having a constant arbitrary cross section (simulating the material's particle) with an absolutely rigid surface (simulating the working body of the crusher), taking into account the time parameter and linear dimension of the moving rod element (particle). The developed refined mechanical and mathematical model, which has been reduced to applicable calculated analytical dependencies and illustrated by typical numerical examples, allows to quantify the strength of the solid particle under destruction and grinding, makes it possible to implement a comprehensive descriptive approach regarding the dynamic process of material particles' grinding by regulating and selecting the optimal physical and geometric characteristics, which provide the required grinding quality and predict the particles' grinding process depending on the process parameters.