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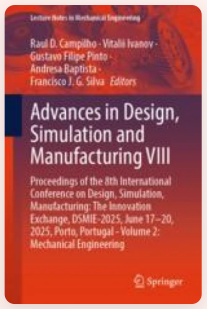

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Abstract

The paper presents a study on the stress-strain state of cylindrical structures with internal material inhomogeneities and their impact on strength and stability under external loads. Particular attention is paid to investigating the influence of factors such as internal defects, material structure inhomogeneities, and the values of mechanical parameters like Young's modulus and Poisson's ratio. It has been established that material inhomogeneities lead to uneven stress distribution, which can cause stress concentrations and local deformations in the material, increasing the risk of crack formation and premature structural failure. The use of mathematical modeling and numerical methods made it possible to predict the behavior of such materials under various loads and provide a more accurate assessment of risk zones. This, in turn, significantly improves the design process and quality control of materials, as well as enhances the reliability of structures during their operation . The experiments conducted confirm the importance of thoroughly analyzing internal defects and the mechanical properties of the material for developing new approaches to assessing the strength and stability of structures. The research results also demonstrated that mathematical models and numerical methods can be effectively used to simulate stress distribution, helping to prevent structural damage, cracks, and potential failures under real operating conditions.

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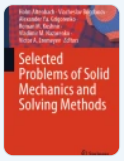

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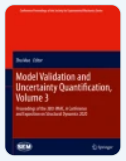

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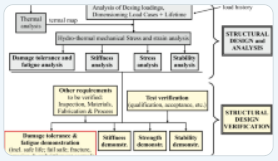

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