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The modeling of selected mechanical properties of plastic materials under influence of complex external load state

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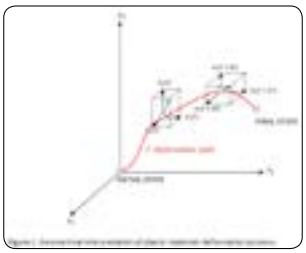
One of the most important and widely used materials is plastic materials. Hence, the knowledge on the behaviour and especially mechanical properties of this type of materials plays an important role in their strength assessment. Very important is here the practical possibility of the prediction of material behaviour under the influence of complex load state; where useful and very important are the strain energy based methods of mechanical properties modelling of material. Such type of approach to the modelling was used by Kurpisz and Wegner among others in [4] and [5]. In the current paper basing on phenomenological approach and interpretation of mechanical experimental characteristics, the strain energy model of plastic material under complex load state in range of elastic deformations, will be introduced. The strain energy density function which is a density of the work of stress components σi(t) for i=1,2,3 along deformation path C:$\varepsilon_i(t)$ for i=1,2,3 defined in the form:

$$W(\varepsilon_1, \varepsilon_2, \varepsilon_3) = \int \sum_{i=1}^{3} \sigma_i \, d\varepsilon_i = \int_0^1 \sum_{i=1}^{3} \sigma_i(t) \varepsilon'_i(t) \, dt$$

will be applied for determination of material stability assumption due to the possibility of the appearing of plastic flow. All theoretical investigations will be illustrated on the example of two types of plastics materials in three-axial state of stress.



Recent Publications:

1. Li Q M (2001) Strain energy density failure criterion. International Journal of Solids and Structures 38(38-39):6997-7013.
2. Valavala P K, Odegerd G M (2007) Multiscale constitutive modeling of polymer materials, ASME 2007 International Mechanical Engineerring Congress and Exposition, 179-183.
3. W Y J, Li J and Faria R (2006) An energy release rate-based plastic-damage model for concrete. International Journal of Solids and Structures 43:583-612.
4. Wegner T and Kurpisz D (2013) Phenomenological modeling of mechanical properties of metal foam. Journal of Theoretical and Applied Mechanics 51(1):203-214.
5. Wegner T and Kurpisz D (2017) An energy-based method in phenomenological description of mechanical properties of nonlinear materials under plane stress. Journal of Theoretical and Applied Mechanics 55(1):129-139.

Biography

Dariusz Kurpisz is a scientific worker at the Poznan University of Technology. His scientific interest includes mathematical modeling of physical process both for materials as well for more complicated structures. One of the most important tools in his work are phenomenological approach and energy method of modeling based on experimental approach and the strain energy density function.

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