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Modeling and experimental verification of the new smart material Vacuum Packed Particles

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Abstract

In this work the material parameter identification, simulations and experimental verification of the new smart material Vacuum Packed Particles is presented. The considered material is a structure composed of granular material inside the plastomer coating. When the pressure inside is equal or higher than atmospheric the system behaves like a liquid, otherwise like an elasto-plastic solid with a temperature and strain rate dependence. By changing the underpressure inside the coating it is possible to control the mechanical properties of the structure in a real time. In this work the approach to model parameter estimation is presented. Additionally, the proposed model is implemented into LS-DYNA code Finite Element Method. In order to verify the simulation results a corresponding experimental tests were conducted using optical strain measurement system. The comparison of the outcomes showed a good correlation. At the end of the paper some new engineering application using this material will be presented.

Biography:

Piotr Bartkowski has completed his PhD at the age of 28 years from Warsaw University of Technology. He works at Faculty of Automotive and Construction Machinery Engineering as a scientist.

Speaker Publications:

1. Forming Ability of Ultrafine-Grained Aluminum Plates Processed by Incremental ECAP; July 2019Advanced Engineering Materials 21(10); DOI: 10.1002/adem.201900473
2. Parameter identification of Bouc-Wen model for vacuum packed particles based on genetic algorithm; March 2019Archives of Civil and Mechanical Engineering 19(2):322-333; DOI: 10.1016/j.acme.2018.11.002; Project: Modeling Vacuum Packed Particles
3. Empirical determination of the mechanical properties of Vacuum Packed Particles; January 2019MATEC Web of Conferences 254(5):05008; DOI: 10.1051/matecconf/201925405008
4. Prototype of a controllable damper based on granular materials subjected to partial vacuum; January 2019MATEC Web of Conferences 254(44):05009; DOI: 10.1051/matecconf/201925405009
5. Passive safety system for small unmanned aerial vehicles; January 2018MATEC Web of Conferences 157(1):03001; DOI: 10.1051/matecconf/201815703001

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