Institute of Thermomechanics Seminar

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Lecture No. 119

Czech Society for Mechanics and Institute of Thermomechanics, CAS

invite you to a Research seminar on **08/31/2023**

Theoretical and computational study on inelastic mechanics of cellular materials

given by

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The cellular microstructure is observed in wood, cork, bone, and honeybees' honeycomb which possesses the characteristic of stiff structures and light weight. The man-made material with cellular architecture called the cellular material is expected to behave the feature of natural materials. The investigation on elastic features of cellular materials has been conducted several decades due to its biological counterparts possess the attractive characteristic. However, biological/natural cellular materials usually behave rate-dependent features as well as the existence of permanent deformation but few attentions have been paid to the inelastic properties of cellular materials. In this study, we use the theoretical and computational ways to study the inelastic behavior of the 2D cellular materials. To investigate the viscoelastic feature of the cellular materials, the unit-cell approach is adopted and a viscoelastic model of 2D cellular materials is proposed. Then the analytical response of the material under different loadings is derived. After the validation of our model, the influence of microstructure on viscoelastic features of 2D cellular materials is observed and analyzed qualitatively and quantitatively. To investigate the plastic behavior of the cellular materials, a finite element analysis on the yield surface of 2D cellular materials is developed and a representative block is selected to represent the effective feature of the cellular materials. After probing paths and preloading paths are designed, the initial and subsequent yield surface of the 2D cellular materials with different relative density are detected and the influence of relative density on the yield surface evolution is investigated. Further, phenomena of cellular materials including the Bauschinger effect and the hardening behavior (isotropic, kinematic, rotation, distortional) are observed from the yield surface evolution of the cellular materials. Based on the computational approach, we explore the mechanics of trabecular bone which has non-periodic cellular microstructure and behaves the asymmetry yield stresses in tension and compression. The computation shows that trabecular bone experiences the distortional yield surface and the appearance or disappearance of the Bauschinger effect during different loading

The lecture will be held on Thursday, August 31, 2023 at 10:30
in the building of the Institute of Thermomechanics (large lecture room),
Dolejškova 5, 182 00 Prague 8

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