הפקולטה להנדסת מכונות
Faculty of Mechanical Engineering

הטכניון מכון טכנולוגי לישראל
TECHNION Israel Institute of Technology

SEMINAR - סמינר

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ב' 21.06.21
(י"א בתמוז תשפ"א), בשעה 14:30 באמצעות הזום: https://technion.zoom.us/j/95602634115

מרצה:

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על הנושא:

Micro to macro scale modelling of anisotropic heterogeneous materials

The seminar will be given in English

להלן תקציר ההרצאה:

Many materials such as cellular materials, composites and alloys are heterogeneous, and their microstructure essentially determines their macro-scale mechanical behavior. A good understanding of the macro-scale behavior and the underlying micro-scale mechanism of such materials will be valuable to guide their applications, and to optimize and design new materials with excellent mechanical performance. To this end, an anisotropic polymeric foam was studied as an example, in terms of experiments, micro/meso-scale finite element (FE) simulation and constitutive modelling. The polymer foam was first subjected to static and dynamic compression at various angles to foam-rise direction, to characterize the anisotropy and strain rate-dependence of its mechanical response. To analyze the mechanisms for various macro-crushing modes and associated post-yield hardening responses observed in compression tests along different directions, a micro/meso-scale structural FE model, comprising an assembly of foam cells, was established and employed to examine meso-scale deformation of foam cells. Finally, a continuum constitutive model with anisotropic post-yield hardening was developed, for incorporation into FE codes to simulate response of structures made of polymeric foams. Although the aforementioned micro to macro scale research is significant to help understanding the mechanical behavior of anisotropic cellular materials, this hierarchical research methodology is unable to directly show the cross-scale relationship between the macro-scale behavior and micro-scale constituents. To provide insight in this matter we will introduce a newly developed monolithic method for concurrent multiscale analysis of heterogeneous materials, i.e., direct finite element square (FE^2) method. Different from the traditional multiscale modelling methods which generally require programming specific control scripts to exchange information between micro and macro scales, the direct FE^2 method directly connects the micro-scale RVE to the macro-scale elements using multiple points constraints (MPCs), a commonly used feature in most FE software. This not only eases the numerical implementation of multiscale analysis of heterogeneous materials, but also significantly increases the computational efficiency. These advantages make the direct FE^2 method a promising approach for commercial multiscale analysis both in academia and industry.

מארח: פרופ' מיכאל שפירא

בברכה,

פרופ"ח מתי' סוס
מרכז הסמינרים