Symposium 24

Modelling Complex Materials: Mechanical Behavior Below the Scale of the Representative Volume Element.

Organizers:

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Modelling the mechanics of heterogeneous materials is traditionally approached from the point of view of homogenization and effective materials properties. When approaching small system sizes, however, classical volume averaging techniques are challenged in two ways: 1. microstructural elements (e.g cracks, dislocations or polymer chains) are extended geometric objects. Averaged descriptions of the defect state therefore require advanced geometrical techniques in conjunction with statistical averaging. 2. In many situations the response of materials is controlled by fluctuations. The latter is obvious with regard to small systems common in modern micro- and nanotechnologies, where component sizes may well fall well below the scale of the 'representative volume element' (RVE) of traditional homogenization theory. Other examples include transport phenomena where collective processes may lead to fluctuations with macroscopic correlation length, or failure processes where extreme fluctuations may govern the macroscopic sample behaviour.

The Symposium will gather mathematicians and researchers working in computational materials science and mechanics of materials. Covered topics include:

- Statistical theories of deformation and failure of heterogeneous materials
- Application of statistical geometry to materials science
- Stochastic finite elements
- Fluctuations in collective transport phenomena
- Theory and numerics of collective dynamics of defects in materials
- Extreme events in complex systems: Applications to materials failure