

Symposium proposal for World Congress in Computational Mechanics in 2018
<http://www.wccm2018.org>

Modeling and Design with Material Variability due to Nano/microstructure

Traditionally, simulation-based design works upon the premise that only the mean behavior of material parameters, but not on their variations, are significant. Material property variations can become critically important for some applications. For example, additively manufactured materials have large variations in microstructure resulting in significant variability in properties and the response of components. Precipitate-hardened alloys provide another example of microstructure engendering variability in mechanical response. The difference in the elastic moduli of the matrix and precipitate together with the interfacial energy manifests in a variance of precipitate shapes. In turn, this microstructure affect dislocation motion and pinning, which determines the distribution of hardening response. Methods to characterize these types of microstructure-induced have commonalities with the statistical mechanics used to treat thermal fluctuations, which are ubiquitous at the nanoscale.

We solicit development and discussion of models of inherent material variability using modern uncertainty quantification, statistical and/or machine learning techniques. We are also interested in development of robust design techniques to handle material variability. Applications ranging from the statistical variation induced at the nanoscale by thermal fluctuations to those induced by microstructure such as grain boundaries and defects are encouraged.

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