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Efficient modeling of complex materials across the scales

Scientific area: Computational Solids And Structural Mechanics

In order to efficiently utilize modern materials in the design process, predictive numerical methods that accurately capture the response of these materials are needed.

While numerical models fully resolving the underlying material's microstructure possess the required accuracy, they typically come at a prohibitive computational cost, precluding any practical use.

Addressing this challenge, homogenization techniques that capture the key mechanisms through which the materials' microstructure affects the effective behavior at larger scales have been developed.

Alongside the homogenization approaches, several phenomenological theories, including extended continua such as higher-gradient, integral, and micromorphic continua, have been proposed to incorporate the influence of material microstructure on macroscopic behavior.

Similar generalized continua may also emerge from the homogenization in the form of, e.g., micromorphic models.

For this mini-symposium, we invite researchers to present and discuss methods of scale-bridging in the computational modeling of complex and smart materials, including

- homogenization strategies for emergent phenomena in both natural and man-made materials,
- effective phenomenological models,
- models of material microstructures (including their randomness),
- designs and optimization of advanced architectured and smart materials.

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