

Title:

*Advanced Modeling and Simulation in Biomechanics:
from Molecules to Tissues*

Organizers:

Gerhard A. Holzapfel
(Graz University of Technology, Austria & NTNU, Trondheim, Norway)
e-mail: holzapfel@tugraz.at

José Manuel García-Aznar
(Universidad de Zaragoza, Spain)
e-mail: jmgaraz@unizar.es

Adrian Buganza Tepole
(Purdue University, USA)
e-mail: abuganza@purdue.edu

Abstract:

This invited session focuses on new theories, computational techniques, and data-driven frameworks to advance our understanding of tissue mechanobiology from molecules to cells to tissues. Living materials grow, remodel, and respond to mechanical cues through a coordinated response across spatio-temporal scales. The mechanobiological feedback is complex and involves nonlinear mechanics at the larger scales such as viscoelasticity, poroelasticity, damage, and plasticity, coupled to changes in tissue microstructure and composition, and further regulated by the molecular machinery at the cell-material interface and inside the cell. This invited session aims to discuss recent advances in these areas, with a particular focus on the mechanics at the molecular, cellular, and tissue level that enable living materials to mechanoadapt to their environment. Of particular interest are methods that consider the coupling of mechanics and mechanobiology across scales. Topics of interest include:

- Nonlinear material properties of molecules, cells and tissue
- Modeling of morphogenesis with advanced particle methods, phase field methods
- Multi-scale models of molecules, cell and tissue dynamics
- Data-driven and machine learning frameworks to couple biomechanics across scales