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COMPUTATIONAL MECHANOTRANSDUCTION

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ABSTRACT

Mechanotransduction poses demanding numerical challenges: multiscale coupling, strong nonlinearities, history effects, and data assimilation under noise. This TS invites contributions on **numerical methods** to **measure**, **model**, and **control** mechano-biological phenomena across cells, tissues, and organs, with applications ranging from development and cancer to fibrosis, aging, and regeneration.

We welcome advances in formulations and discretizations—including standard and mixed FEM, isogeometric, enriched/XFEM, meshfree/particle methods, finite volumes, and boundary elements—with robust treatment of large deformations, growth, viscoelasticity, active stresses, and contact. Topics include time integration and thermodynamically consistent structure-preserving schemes; a posteriori error estimation and goal-oriented adaptivity; inference and control, inverse problems (adjoint, Gauss–Newton, variational regularization), Bayesian approaches, and uncertainty quantification (stochastic Galerkin/collocation, variance-reduction); as well as reduced-order modeling, physics-informed learning, and digital twins that fuse data with models

TS Topics

- Discretizations/formulations for tissue mechanics and multiphysics
- Stability, convergence, V&V; error estimators and adaptive strategies
- Solid–fluid–transport coupling: monolithic vs. partitioned; time integration
- Inverse problems, data assimilation, and uncertainty quantification
- Reduced-order models and digital twins; physics-informed ML