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Computational treatment of slender structures allowing for large rotations

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Major requirements and drivers for developing simulation methods for slender and thin-walled structures are accuracy, sustainability as well as the efficient use of computational time and memory. The use of dimensionally reduced structural elements instead of three-dimensional solid elements leads to lower computational costs but gives rise to a range of challenges.

The dimensional reduction can introduce degrees of freedom that do not live in linear vector spaces, e.g. nodal directors or director triads. This non-linearity is the origin of several problems such as missing frame-invariance and artificial path-dependence and thus, a special algorithmic and theoretical treatment is required. Proving the existence of minimizers and well-posedness is mathematically challenging and an open topic for some models. Locking derogates the pre-asymptotic rate of convergence and the elegance of the approach. Thin-walled structures typically show high frequencies in the thin directions, thus proper mass scaling plays an important role for explicit dynamic analyses to improve the efficiency of the formulations. Advanced discretization schemes play a key role in overcoming these challenges, i.e. IGA, finite difference schemes and collocation methods.

This minisymposium invites all researches in the field of structural mechanics, applied mathematics and related fields to present their recent work, both with focus on method development and on applications.

Topics of interest include, but are not limited to:

- formulations for shells, plates or beams with single- or multi-layer kinematics
- locking and numerical stability of structural element formulations
- inclusion of materially non-linear behavior for structural element formulations
- mass scaling techniques for structural element formulations
- application of structural elements to, e.g., optimization, code parallelization, stability analysis, transient analysis
- application to advanced discretization schemes, e.g., IGA, collocation

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