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Isogeometric weighted residual formulation and collocation for Kirchhoff rods and shells

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With isogeometric analysis, the Galerkin rotation-free discretization of Kirchhoff rods and Kirchhoff–Love shells is simplified, enabling more efficient simulations of thin structures. High-order shape functions also allow the solution of the weighted residual formulation of the strong form, opening the development of new integration schemes (e.g. reduced Gauss–Lobatto quadrature, integration at superconvergent sites) but also of collocation methods (e.g. using Greville or superconvergent collocation points).

The goal of the presentation is to compare these different methods when they are applied to structures modeled by the planar Kirchhoff rods or the Kirchhoff–Love shells under large nonlinear deformations. The collocation strategy at the boundaries of these two fourth-order problems deserves special attention and will be also addressed. Finally, based on the observations, convergence orders are specified for each method. Advantages and weaknesses in terms of implementation, convergence robustness and computation cost are also discussed.

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