Finite Element Methods for Curvature Computation

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In this talk we present recent results on discretizing curvature by finite element methods. One application is the simulation of elastic shells, where the bending energy is described by the change of curvature with respect to a reference configuration. Here we need extrinsic curvature of embedded manifolds, i.e. of surface meshes in R3. In the second part we talk about intrinsic curvature, where only the metric information inside the surface is available. Intrinsic curvature is needed also for numerical relativity. Both approaches need the concept of distributional derivatives. We show that finite elements of Hellan-Herrmann-Johnson and Regge-type match with these distributions. We show how to use these methods within the NGSolve finite element package.

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