C^0–discontinuous Galerkin approach for vesicle shape deformation

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This work concerns the development of a finite–element algorithm to discretize the phase–field model for the shape deformation of a vesicle based on the idea of discontinuous Galerkin method. The phase–field model originated from minimization of Canham–Helfrich elastic bending energy involves fourth–order gradients and thus C^1–basis functions are required for the standard conforming Galerkin formulation. We introduce a relatively inexpensive, nonconforming method based on C^0–basis functions. We present the variational form of the method including additional terms to weakly enforce continuity of the derivatives across interelement boundaries and its stabilization is achieved via Nitsche's method. Numerical tests for the equilibrium shape of a single component vesicle are performed to demonstrate the performance of the proposed variational formulation.