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摘要
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ANALYSIS OF A MIXED FINITE ELEMENT METHOD FOR A PHASE FIELD BENDING ELASTICITY MODEL OF VESICLE MEMBRANE DEFORMATION

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Abstract In this paper, we study numerical approximations of a recently proposed phase field model for the vesicle membrane deformation governed by the variation of the elastic bending energy. To overcome the challenges of high order nonlinear differential systems and the nonlinear constraints associated with the problem, we present the phase field bending elasticity model in a nested saddle point formulation. A mixed finite element method is then employed to compute the equilibrium configuration of a vesicle membrane with prescribed volume and surface area. Coupling the approximation results for a related linearized problem and the general theory of Brezzi-Rappaz-Raviart, optimal order error estimates for the finite element approximations of the phase field model are obtained. Numerical results are provided to substantiate the derived estimates.

Key words Bio-membrane Elastic bending energy Phase field Finite element Nested mixed saddle point formulation Optimal error estimates.

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