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# Isogeometric analysis for sixth-order boundary value problems of gradient-elastic Kirchhoff plates

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## Abstract

Sixth-order boundary value problems of a one-parameter gradient-elastic Kirchhoff plate model are formulated in a weak form within an  $H^3$  Sobolev space setting with the corresponding equilibrium equations and general boundary conditions. The corresponding conforming Galerkin method is proposed with error estimates for discretizations satisfying  $C^2$  continuity requirements. Continuity, coercivity and consistency of the corresponding bilinear form are utilized for proving the theoretical results. Numerical computations with conforming isogeometric discretizations of  $C^{p-1}$ -continuous NURBS basis functions of order  $p \geq 3$  confirm the theoretical results and illustrate the features of the problem for both statics and free vibrations. In particular, the effects of the additional boundary conditions and parameter-dependent boundary layers corresponding to the gradient elasticity theory are addressed by the numerical examples.

*Keywords:* Generalized continuum, Gradient elasticity, Kirchhoff plate, Isogeometric analysis, Convergence analysis, Error estimates

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