

## A Generalized Finite Element Method for the Displacement Obstacle Problem of Clamped Kirchhoff Plates

**Susanne C. Brenner**

Department of Mathematics and Center for Computation & Technology,  
Louisiana State University, Baton Rouge LA, 70803, U.S.A., [brenner@math.lsu.edu](mailto:brenner@math.lsu.edu)

**Christopher B. Davis**

Department of Mathematics and Center for Computation & Technology,  
Louisiana State University, Baton Rouge LA, 70803, U.S.A., [cdav135@math.lsu.edu](mailto:cdav135@math.lsu.edu)

**Li-Yeng Sung**

Department of Mathematics and Center for Computation & Technology,  
Louisiana State University, Baton Rouge LA, 70803, U.S.A., [sung@math.lsu.edu](mailto:sung@math.lsu.edu)

**Keywords:** *PUM, Obstacle Problem*

### ABSTRACT

The obstacle problem for clamped Kirchhoff plates is a fourth order variational inequality. The numerical analysis of this problem is more difficult when compared to its second order counterpart. This is due to the fact that the fourth order problem does not have full elliptic regularity where the second order problem does; and hence the strong form of the variational inequality is not available for the error analysis of the fourth order problem. A unified convergence analysis for conforming finite element methods, nonconforming finite element methods, and discontinuous Galerkin methods for this problem on convex polygons with homogeneous Dirichlet boundary conditions has been developed in [1]. These results then were extended to a  $C^0$  interior penalty method and a Morley finite element method for general polygonal domains and general Dirichlet boundary conditions in [2,3]. The goal of this work is to extend these results to a generalized finite element method [4]. In this talk I will go over the construction of the approximation space, convergence analysis, and numerical examples.

### REFERENCES

- [1] S.C. Brenner, L.-Y. Sung, and Y. Zhang. Finite element methods for the displacement obstacle problem of clamped plates. *Math. Comp*, Vol. **81**, 1247-1262, 2012.
- [2] S.C. Brenner, L.-Y. Sung, H. Zhang, and Y. Zhang. A quadratic  $C^0$  interior penalty method for the displacement obstacle problem of clamped Kirchhoff plates. preprint.
- [3] S.C. Brenner, L.-Y. Sung, H. Zhang, and Y. Zhang. A Morley finite element method for the displacement obstacle problem of clamped Kirchhoff plates, submitted. preprint.
- [4] S.C. Brenner, C.B. Davis, and L.-Y. Sung. A generalized finite element method for the displacement obstacle problem of clamped Kirchhoff plates, submitted. preprint.