DPG FOR PLATE BENDING, PART II

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Abstract. The discontinuous Petrov–Galerkin method with optimal test functions (DPG method) is a family of schemes that combine the use of product test spaces with so-called optimal test functions to automatically satisfy the discrete inf-sup condition. In this form it has been proposed by Demkowicz and Gopalakrishnan [2], initially for transport problems. Since then, DPG settings have been developed for several problems of different types. An important class of models is that of plate bending. Two linear cases are the Kirchhoff–Love and the Reissner–Mindlin models. A first DPG approximation for the latter one has been proposed in [1]. The Reissner–Mindlin model can be interpreted as a singularly perturbed case of the Kirchhoff–Love formulation. There are many numerical schemes for the Reissner–Mindlin case, and the holy grail is to obtain robust approximations with respect to the plate thickness. The setup from [1] does not consider this perturbation.

Our aim is to use DPG techniques to approximate model variables that are less regular than the deflection or rotation. Specifically, we have developed DPG schemes that include the approximation of bending moments, also in the case of non-convex polygonal plates [3, 4].

In our presentations, we will report on these DPG schemes and their analysis. We specifically include fully discrete variants that take into account the approximation of optimal test functions.

Keywords: Kirchhoff–Love model, Reissner–Mindlin model, plate bending, fourth-order elliptic PDE, discontinuous Petrov–Galerkin method, optimal test functions, Fortin operator

Mathematics Subject Classifications (2010): 74S05, 74K20, 35J35, 65N30, 35J67

Acknowledgment: Support by CONICYT through FONDECYT projects 1150056 and 11170050 is gratefully acknowledged.

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