DPG APPROACH FOR DEALING WITH STRESS CONCENTRATIONS

THOMAS FÜHRER, NORBERT HEUER, ANTTI H. NIEMI*

ABSTRACT

Stress concentrations may occur in structural engineering e.g. in the vicinity of concentrated loads, abrupt transitions between materials or sharp re-entrant corners. Whether the local stress peaks and distributions really matter from a practical perspective, or could be considered as artefacts of the mathematical model, depends on the particular application under consideration. In any case, accurate stress predictions with evidence of convergence and knowledge of the stress peaks are prerequisites for reliable failure predictions of structures.

In this presentation, a DPG approach suitable for strength analysis of plate and shell structures is outlined. The underlying mathematical models are assumed to be of Kirchhoff-Love type, where the transverse shear stress resultants are defined in terms of the equilibrium equations only. The DPG approach is based on the trace theory developed in [1]. Recently, a formulation that can capture adaptively boundary and interior layers of curved shell deformations has been proposed in [2]. The presentation summarizes the most important theoretical findings together with numerical convergence studies for selected benchmark problems.

References

[1] Führer, T., Heuer, N. and Niemi, A.H., *An ultraweak formulation of the Kirchhoff-Love plate bending model and DPG approximation*, Math. Comp. 88 (2019), pp. 1587–1619.

[2] Führer, T., Heuer, N. and Niemi, A.H., *A DPG method for shallow shells*, Numer. Math. 152 (2022), pp. 67–99.

* Civil Engineering Research Unit, Faculty of Technology, University of Oulu, Finland, antti.niemi@oulu.fi