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DPG boundary elements with optimal test functions on surfaces

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Abstract

We present an ultra-weak formulation of a hypersingular integral equation on polyhedral surfaces and prove its well-posedness and equivalence with the standard variational formulation. Based on this ultra-weak formulation we present a discontinuous Petrov-Galerkin method with optimal test functions and prove its optimal convergence. The two-dimensional case on (closed) polygons has been studied in [1]. In that situation, appearing derivatives are with respect to the arc length, and Sobolev spaces are only of the L^2 and H^1-type. In this talk we study, in particular, open surfaces, where surface differential operators appear and where singularities in the exact solution prohibit to use simple L^2 and H^1 spaces for the ultra-weak formulation, though spaces of orders $\pm 1/2$ are avoided throughout. Some numerical results are shown that underline our theoretical estimates.

Key words: boundary element method, discontinuous Petrov-Galerkin method, optimal test functions

Mathematics subject classifications (1991): 65N30

References

[1] N. Heuer and F. Pinochet, *Ultra-weak formulation of a hypersingular integral equation on polygons and DPG method with optimal test functions.* arXiv:1309.1697, 2013.

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