A SPACETIME DPG METHOD FOR THE WAVE EQUATION IN MULTIPLE DIMENSIONS

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Abstract. There has been increasing interest recently in direct spacetime discretizations, where time is viewed as another coordinate. Some reasons for investigating these approaches include their potential for naturally performing spacetime adaptivity, the possibility to obtain convergence even under limited spacetime regularity, the exploitation of parallelism without causality constraints, and the treatment of moving boundaries. Since the DPG method has a built-in error estimator and exhibits good pre-asymptotic mesh-independent stability properties, it is natural to consider its extension to spacetime problems.

In this talk, we will present the conditions that lead to a well-posed weak formulation, and how the built-in estimator of the DPG method is useful for spacetime adaptive refinements for the wave operator. For practical implementations of the wave problem, we will show that depending on how the interfacial variables are treated, the discrete system may have a nontrivial kernel for some alignments of facets. Strategies that can deal with the nontrivial kernel and lead to optimal convergence rates in different types of meshes will be presented.

Keywords: time-dependent, wave equation, hyperbolic, discontinuous Petrov-Galerkin, finite element method.

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References

[1] J. Gopalakrishnan and P. Sepúlveda. A spacetime DPG method for the wave equation in multiple dimensions. arXiv:1709.08268, 2018.

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