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RESIDUAL-MINIMIZING APPROACHES FOR TRANSIENT PROBLEMS ON NEXT-GENERATION COMPUTING ARCHITECTURES

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The discontinuous Petrov-Galerkin (DPG) methodology of Demkowicz and Gopalakrishnan minimizes the solution residual in a user-controllable norm; the mathematical structure provides stability even on a coarse mesh, usually without the need for careful analysis for each new PDE under consideration, and without requiring stabilization terms to be added or the trial space to be carefully constructed. Camellia is an open-source library, built atop Trilinos, that aims to provide a computationally efficient environment for rapid development of solvers for DPG and other finite element methods.

To date, the focus in DPG research has largely been on steady-state equations. There have been several studies of space-time DPG, but the sole examination of time-stepping techniques for DPG in the literature of which we are aware is a mathematical analysis of Rothe's technique for an ultraweak formulation of the heat equation by Führer et al.

Here, building on the work of Führer et al., we present and compare several other time-stepping approaches for DPG and DPG-like formulations of the heat equation, with particular concern for computational costs on next-generation computing architectures. We are now converting Camellia to make use of Kokkos to allow performance portability; we present some performance results for DPG-like formulations running on GPU accelerators.

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