Robust discretization and reliable and efficient error control for general first-order systems

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We discuss a class of discontinuous Petrov-Galerkin schemes obtained by substructuring. The method allows to discretize very general differential operators and yields a solution procedure where only positive definite linear systems have to be solved. These systems arise from the reduction to interface values of the skeleton corresponding to a domain decomposition. In the subdomains, in analogy to an inexact Trefftz method a dual problem is solved with higher accuracy. It is shown that this corresponds to local least squares problems in negative norms. The method coincides with the DPG method introduced by Demkowicz et al. Here, we extend the numerical analysis of this method and we consider new applications. Moreover, the method comes along with full error control with efficient and reliable bounds.

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