

The Role of Interfacial Unknowns in Designing Methods

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ABSTRACT

Finite element methods have long been an indispensable tool in the simulation of processes governed by partial differential equations. Some new finite element methods, of the discontinuous Galerkin (DG) variety, have emerged in recent years, with a common feature: They exploit unknowns at the interfaces of mesh elements in novel ways.

In this talk, we present the development of two such methods, called HDG (Hybridizable Discontinuous Galerkin) Methods and DPG (Discontinuous Petrov Galerkin) Methods. Both use interfacial unknowns, in a transparent fashion, to reduce system size. They also use them, in a more subtle fashion, to obtain stability. We will connect these developments to older domain decomposition and hybridization ideas, moving between existing mathematical and engineering literature. We show, through examples, what could be accomplished by these methods, that previously could not be achieved.