A PARTITIONED METHOD FOR INTERFACE PROBLEMS BASED ON A PRIMAL SCHUR COMPLEMENT

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Abstract. Complex multiphysics applications often require the efficient and stable coupling of individual codes or separately meshed regions through non-matching interfaces. A char- acteristic example of this type of coupling occurs between atmospheric and ocean codes in global Earth system models. Partitioned algorithms are typically used for these systems because they enable the use of separate codes connected through data transfers that supply the necessary boundary conditions at the interface between subdomains. These methods can be thought of as performing a single step of an iterative procedure such as a fixed point iteration or non-overlapping Schwarz. In this talk we describe an alternate approach derived from a monolithic formulation where Lagrange multipliers are used to enforce interface conditions exactly. To obtain a Lagrange multiplier formulation that is fully compatible with explicit time integration we consider a coupling condition which enforces the continuity of the time derivatives of the states across the interface. Assuming that the initial data are continuous across the interface, this alternative coupling condition implies continuity of the state while enabling a fully explicit treatment. For the explicit partitioned method we compute the Lagrange multiplier directly and use it for boundary data in partitioned solves on each domain. Numerical results for advection-diffusion equations demonstrate the stability of the formulation and second-order convergence in both the advection and diffusion dominated regimes.

Keywords: Transmission problems, domain decomposition, Lagrange multiplier, advection-diffusion, finite element method

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