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A GUARANTEED ERROR BOUND SEPARATING ALGEBRAIC AND DISCRETIZATION CONTRIBUTIONS IN NON-OVERLAPPING DOMAIN DECOMPOSITION METHODS

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Abstract. For the last decades, three trends have grown and reinforced each other: the fast growth of hardware computational capacities, the requirement of finer and larger finite element models for industrial simulations and the development of efficient computational strategies amongst which non-overlapping domain decomposition (DD) methods [2, 3, 4] are very popular since they have proved to be scalable in many applications. One main shortcoming in DD lies on the absence of verification of the discretized models in order to warranty the quality of numerical simulations (global or goal-oriented error estimators). In a recent work [1], we introduced a first error estimator in a non-overlapping domain decomposition framework and outlined its connection with two iterative non-overlapping domain decomposition solvers (FETI and BDD). It is fully parallel in the sense that it involves a simple preprocessing of interface tractions and the use of standard black-box sequential error estimators [5, 6, 8] independently on each subdomain. It yields a guaranteed upper bound on the error whatever the state (converged or not) of the iterative solver associated to the interface continuity. It has been numerically observed that our first DD-error estimator enables to recover the same efficiency factor as the standard sequential. However, its main drawback is its inability to separate the algebraic error (coming from the DD iterative solver) from the discretization error per subdomains.

In this talk, we present some of our recent work that aims at separating the algebraic error and the discretization error. We introduce a new guaranteed upper bound that enables to introduce such a separation. This leads to the definition of new convergence criteria of DD iterative solvers based on the estimation of the discretization error instead of purely algebraic criteria. Works in progress are related to (i) goal-oriented error estimator (ii) nonlinear problems.

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