ITERATIVE STRONG COUPLING OF DIMENSIONALLY – HETEROGENEOUS MODELS

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Abstract. Here we address decomposition strategies especially tailored to perform strong coupling of dimensionally-heterogeneous models. The main hypothesis that one wants to solve each submodel separately and implement the interaction between subdomains by boundary conditions alone. The novel methodology takes full advantage of the reduced number of interface unknowns in this kind of problems. Existing algorithms can be viewed as variants of the ïnaturalstaggered algorithm in which each domain transfers function values to the other, and receives fluxes (or forces), and viceversa. This natural algorithm is known as Dirichlet-to-Neumann in the Domain Decomposition literature. The framework presented here makes use of a reinterpretation of the original problem as a partitioned one yielding a system of linear/non-linear equations in terms of interface variables, for which classical linear/non-linear solvers are applied. Indeed, the benefit is that an extremely flexible, automatic coupling strategy can be developed, which in addition leads to iterative procedures that are parameter-free and rapidly converging. Further, in linear problems they have the finite termination property. Examples in heat transfer and fluid mechanics are presented to show the potentialities of the methodology.

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