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Reduced Arlequin Coupling Operators For Solution of Localized-HF Multiscale Dynamic Problems

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A numerical solution of localized High-Frequency dynamic multiscale problems, previously introduced in [1] (see also [2]) and recently pushed farther in [3], form the backbone of the present communication. Some application for the resulting approach are modeling and solution of waves propagating from a first critical High Frequency zone of interest, denoted, $(Zoi)_{HF}$), neighborhood of a seismic-like source (e.g. earthquake, impact, fracturation, etc.) to, say, a Low-Frequency 2^{nd} critical zone $(Zoi)_{LF}$, located significantly far from the $(Zoi)_{HF}$, while coarsely considering damping of the propagating medium. Considering an earthquake, one can imagine that a global refinement of the whole domain, with distance between the seismic source and the infrastructure of the order of tens of Km or more is out of reach for any reasonable computer. Multiscale dynamic methods are thus required. The Arlequin framework initiated in [5] is used herein. The main addressed points in this work are i) when and how one can justify localized HF hypotheses and why the characteristic volume-Arlequin coupling is essential for transient multiscale dynamic problems. ii) A presentation of new reduced characteristic Arlequin-volume-coupling operators, based on "consistent physical pairing" of fine and coarse Lagrange Arlequin multipliers. iii) How to avoid the pollution of $(Zoi)_{HF}$ while transmitting the maximum possible of energy to $(Zoi)_{LF}$. Enlightening numerical tests are shown during the conference.

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