

MULTI-SCALE MECHANICS AND EVOLVING DISCONTINUITIES: COMPUTATIONAL ISSUES

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Multi-scale methods are a new paradigm in many branches of engineering science. When resolving smaller and smaller scale evolving discontinuities become more important, as do non-mechanical effects like humidity and temperature. We will start by a concise classification of multi-scale computational mechanics, and we will concentrate on computational methods that allow for concurrent computing at multiple scales. Difficulties that relate to the efficient and accurate coupling between the various subdomains will be highlighted, with an emphasis on the coupling of domains that are modelled by dissimilar field equations. Next, we will focus on evolving discontinuities that arise at different scales and discuss various methods resolving them, including level sets, phase-field approaches, partition-of-unity methods, and isogeometric analysis. Finally, approaches will be outlined for multi-scale analyses that include coupling of evolving discontinuities with non-mechanical effects.

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