A Distributed Functional Framework for Recursive FE-Simulations

Ralf Ebner
Fakultät für Informatik
Technische Universität München
D–80290 München

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In contrast to standard finite element methods, the recursive substructuring technique assembles the element matrices recursively in several levels. The adaptive version results in an unbalanced tree with equation systems in each node. In order to increase efficiency and to reduce memory consumption, conventional static condensation is replaced by an iterative solver. Its convergence is enhanced by transformation to a hierarchical basis.

For automated parallelization, the method is coded using functional programming in Haskell and in the data flow language FASAN for the topmost coordinating layer (the framework), where data locality is achieved by monads and stream semantics, respectively. Adaptivity requires dynamic load balancing with strategies like bisectors, hashing techniques or the generation of threads.