

OpenPFEM: A Finite Element Software Platform Based on Distributed Mesh Parallel Communication

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Abstract

OpenPFEM is a parallel finite element computing platform developed in C, designed for large-scale parallel finite element computations on high-performance computers. This paper introduces the fundamental architecture of OpenPFEM, with particular emphasis on our parallel data communication scheme based on mesh partitioning. At the sender side of data transmission, the data to be communicated is organized and distributed according to the geometric elements of the mesh, and unified data transmission is carried out based on the topological relationships of each process's sub-mesh; at the receiver side, the received data is similarly processed based on the topological relationships of each process's sub-mesh. This paper demonstrates the application of this parallel data transmission strategy through examples including the computation of residual-type a posteriori error estimates for finite element functions, stress-strain tensors of finite element functions, and reordering of interpolation matrices after mesh load balancing.

Note: Figure translations are in progress. See original paper for figures.

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