

A New Parallel Structural Analysis Framework

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Abstract

This paper introduces a new Parallel Structural (ParaStruc) analysis framework. This framework combines a newly introduced Row-wise Parallel Finite Element Analysis Algorithm (RWPFEA) with a new set of parallel numerical and communication libraries (Trilinos). By implementing RWPFEA, higher level of parallelism is achieved, because RWPFEA parallelizes all of the four major steps of finite element analysis. In addition, RWPFEA inherently provides a Dynamic Load Balancing (DLB) mechanism which is essential in maximizing the parallel efficiency of nonlinear analyses of structures. The performance of the new framework is evaluated using a shared-memory parallel environment with Silicon Graphics Altex 3700 supercomputer, and using a distributed-memory parallel environment using Apple Xserve G5 compute cluster. In both cases, a 3-dimensional simulation of 50-story/10-frame/10-bay undergoing nonlinear response is carried out. The performance results of this simulation are presented in this paper which show high parallel speedups and efficiencies, especially for the case of distributed-memory environment due to the substantial increase of memory as the number of processors is increased.