

Distributed NSGA-II for seismic retrofitting optimization with multi-core PC cluster

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Abstract

The distributed Genetic Algorithm (GA) for PC cluster with multi-core-CPU is proposed as a time reducing method for determining the schemes of retrofitting existing buildings with Buckling restrained Brace (BRB). Non-dominated Sorting Genetic Algorithm-II (NSGA-II), one of the derivative evolutionary algorithm in heuristic method, was applied since the optimization problem have a multi-objective function. Two problem case was selected for validating performance of the distributed GA. The first case is seismic retrofitting of a two-dimensional steel frame structure with nonlinear static analysis, and the other one is seismic retrofitting of a three-dimensional reinforced concrete frame structure with nonlinear dynamic analysis. The objectives in both problems are minimization of cost for retrofitting and damage of retrofitted frame structure. To reduce the time for searching optimal solutions, the cluster computer consists of off-the-shelf Personal Computer (PC) with central processing unit (CPU) of quad-core processor was used. The PCs of the cluster were connected to local area network (LAN) through network switch have gigabits bandwidth. As a result, this study confirmed the possibility of using the cluster computer composed with multi-core-CPU as High Performance Computing (HPC) for seismic retrofitting optimization.

Keywords: seismic retrofitting; buckling restrained braces (BRBs); design optimization; genetic algorithms (GA); personal computer cluster; multi-core-CPU.