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Optimal Sensing Technique for Estimating Stress Distribution of 2-D Steel Frame Structure Using Genetic Algorithm

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Abstract : For the structural safety, the maximum stress calculated from the stress distribution of a structure is widely used. The stress distribution can be estimated by deformed shape of the structure obtained from measurement. Although the estimation of stress is strongly affected by the location and number of sensing points, most studies have conducted the stress estimation without reasonable basis on sensing plan such as the location and number of sensors. In this paper, an optimal sensing technique for estimating the stress distribution is proposed. This technique proposes the optimal location and number of sensing points for a 2-D frame structure while minimizing the error of stress distribution between analytical model and estimation by cubic smoothing splines using genetic algorithm. To verify the proposed method, the optimal sensor measurement technique is applied to simulation tests on 2-D steel frame structure. The simulation tests are performed under various loading scenarios. Through those tests, the optimal sensing plan for the structure is suggested and verified.

Keywords : genetic algorithm, optimal sensing, optimizing sensor placements, steel frame structure
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