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<u>**PROCEEDINGS**</u>

Structural Damage Identification Using Modal Energy and Improved Hybrid Gradient-Based Optimizer

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ABSTRACT

Structural damage identification is a key engineering technique that attempts to ensure structural reliability. In this regard, one of the major intelligent approaches is the inverse analysis of structural damage using metaheuristics. By considering the recent achievements, an efficient hybrid objective function that combines the modal kinetic energy and modal strain energy is developed. The objective function aims to extract maximum modal information from the structure and overcome noisy conditions. Moreover, the original methods are usually vulnerable to the associated high multimodality and uncertainty of the inverse problem. Therefore, the particle swarm algorithm (PSO) mechanism is combined with another newly developed algorithm, the gradient based optimizer (GBO). The new algorithm, called the gradient based particle swarm optimization (GBPSO), with the acceleration improvements, enhances exploration, and the local escaping operator of GBO is developed to deal with the complex inverse analysis of structural damage problems. Furthermore, the introduced structural damage detection approach is applied using several damage cases in frame structure. The introduced approach exhibits dominant performance and robust results when dealing with the inverse analysis of structural damage problem.

KEYWORDS

SHM, Metaheuristics; inverse problem; modal features

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.