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A Model-Based Method for Damage Localization and Qualification in a Cable-Stayed Bridge

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Abstract **-** To propose an effective optimization-based model updating and damage detection method, not only a damage-sensitive cost function is required, but also a strong and stable optimization algorithm should be employed. This paper is aimed at presenting a method in which both the mentioned challenges are considered for damage identification in cable-stayed bridges. For this purpose, the damage detection problem is formulated as a modal flexibility-based model updating approach and it is solved utilizing Democratic Particle Swarm Optimization (DPSO) algorithm. DPSO is a modified version of the standard PSO algorithm, which is developed for presenting a tackle the drawbacks of the original PSO algorithm in terms of increasing the algorithm's speed as well as decreasing the premature convergence rate. The efficiency of the method is demonstrated by studying different damage patterns on the numerical model of a cable-stayed bridge. Almost all the obtained results indicate the good performance of the proposed method for the damage localization and quantification of the cable-stayed bridge using only the first several modes' data.

Keywords**:** Structural Damage Detection, Cable-stayed Bridges, Democratic Particle Swarm Optimization algorithm (DPSO), Modal flexibility matrix