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Application of Artificial Intelligence and Meta-heuristic Algorithms in Civil Health Monitoring Systems

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Abstract

After the discovery and manufacturing of every accomplishment, the mankind tends to make it sustainable in terms of different aspects that one of them can be its durability. Nowadays, a science titled "health monitoring" has provided such a consideration in different fields. For example, civil engineering sciences, in various branches, aim to construct various civil engineering accomplishments, followed by the higher goals of making them durable and healthy. The present study tries to give an account about the various study fields like structural engineering, bridge construction, dam construction, hydraulic and on-beach constructions, road engineering and building, water resources management and so on along with the mentioning of the various methods extant for the implementation of such study fields. But, in between, there is an appropriate method that provides such objectives as cost-effectiveness, access to the entire required details, awareness of the civil infrastructures in order to estimate the remained lifetime of the structure in line with the continuation and/or change of the uses. Also, it has high precision and minimally influenced by the environment, so, it can be said that it has very little error in its collection of information. For instance, this method can be used to evaluate the ruination of the structures based on modal properties, which can have static or dynamic foundations such that the current state of the structure is compared to its ideal state to monitor the degree of the structure's ruination or its soundness. In present study, it was tried to investigate the artificial intelligence science as one of the richest methods possessing all the prerequisites as well as having more traits in common with the various sub-disciplines of civil engineering so that it can be utilized more comprehensively and in a more centralized manner.

Keywords: Health Monitoring; Modal Features; Dynamic Methods; Static Methods; Breakdown.

1. Introduction

The science of health monitoring has been specifically examined in various areas of civil engineering and also, more precise methods have been developed for monitoring the structures' soundness due to ever-increasing progresses made in sciences; but, these methods have their own weaknesses and strengths. As an example, the structural conditions of a bridge are visually inspected on a regular basis. Besides the time-consuming and costly nature of these inspections, the monitoring of the entire bridge structure is impossible due to lack of access to certain cross-sections. Therefore, applying a non-destructive damage identification method is necessary to simultaneously increase the safety and ensure the status quo of the structure. During the recent years, vibration-based damage identification has been used to evaluate the damage of entire structure. In such a state, the recognition of the structural failures is based on the idea that dynamic response of the structure will be changed as a result of damage. In this way, it is possible to determine the location and the intensity of the damage by examining dynamic response of the structure before and after advent of the damage. The present study

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