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Optimal sensor placement for Canton Tower using virus monkey algorithm

*Ting-Hua Yi[1)], Hong-Nan Li[2)], and Xu-Dong Zhang[3)]

[1), 2), 3)] *School of Civil Engineering, Dalian University of Technology, Dalian 116023, P.R.China*
[1)] *yth@dlut.edu.cn*

ABSTRACT

Placing sensors at appropriate locations is an important task in the design of an efficient structural health monitoring (SHM) system for a large-scale civil structure. In this paper, a hybrid optimization algorithm called virus monkey algorithm (VMA) based on the virus theory of evolution is proposed to seek the optimal placement of sensors. Firstly, the dual-structure coding method is adopted instead of binary coding method to code the solution. Then, the VMA is designed to incorporate two populations, a monkey population and a virus population, enabling the horizontal propagation between the monkey and virus individuals and the vertical inheritance of monkey's position information from the previous to following position. Correspondingly, the monkey population in this paper is divided into the superior and inferior monkey populations, and the virus population is divided into the serious and slight virus populations. The serious virus is used to infect the inferior monkey to make it escape from the local optima, while the slight virus is adopted to infect the superior monkey to let it find a better result in the nearby area. This kind of novel virus infection operator enables the coevolution of monkey and virus populations. Finally, the effectiveness of the proposed VMA is demonstrated by designing the sensor network of the Canton Tower, the tallest TV Tower in China. Results show that innovations in the VMA proposed in this paper can improve the convergence of algorithm compared with the original MA.

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[1)] Professor
[2)] Professor
[3)] Graduate Student