# Structural Health Monitoring via Metaheuristic Optimization Tools

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## ABSTRACT

One of the most important aims of structural health monitoring is to identify the presence of damage by assessing the differences between the present behaviour of a structure and its reference initial state. In the last decades, significant research advances have been carried out in the field of optimization. Herein, a highly nonlinear objective function that minimizes the discrepancy between the analytical and the experimental modal features of a structure. Once a finite element discretization of the structure is introduced, the design variables are chosen as the stiffness parameters and the Firefly Algorithm (FA) is applied to proceed the iterations toward global minima. Partial solutions are analysed along different steps of the procedure, and the local optima are identified by estimating the values of the objective function associated to the newly generated stiffness matrices. The damage detection and localization are performed at the end of the optimization process through the comparison between the identified and the analytical stiffness matrices. This method is applied to a numerical example, which is representative of a generic structure where damage is introduced as local stiffness reduction.

## REFERENCES

[1] X-S. Yang, *Engineering Optimization: An Introduction with Metaheuristic Applications,* John Wiley & Sons, Chichester, UK, ISBN: 978-0-470-58246-6 (2010)