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A Hybrid Approach For Structure Damage Identification Using Optimization Algorithm and Artificial Neural Networks

Lan Ngoc-Nguyen[1,2,a], Bao-Lam Nguyen[3,b], Thanh Bui-Tien[2,c] and Magd Abdel Wahab[1*,d]

[1]Soete Laboratory, Faculty of Engineering and Architecture, Ghent University, Belgium

[2]Faculty of Civil Engineering, University of Transport and Communications, Vietnam

[3]Institut supérieur de mécanique de Paris (ISAE-Supméca), Laboratoire Quartz, 3 rue Fernand Hainaut, 93407 Saint-Ouen-sur-seine cedex, France

[a]ngoclan.nguyen@ugent.be, [b]bao-lam.nguyen@isae-supmeca.fr, [c]btthanh@utc.edu.vn, [d]magd.abdelwahab@ugent.be

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Abstract. Structural Health Monitoring (SHM) is a critical aspect of ensuring the safety and longevity of infrastructure, particularly bridges. Effective damage identification in bridge structures is essential for timely maintenance in order to prevent catastrophic failures. Traditional methods of damage identification often face challenges in accuracy and efficiency, necessitating the development of advanced techniques. This paper presents a novel hybrid approach for structural damage identification using an optimization algorithm and Artificial Neural Network (ANN). Specifically, we propose the integration of the African Vulture Optimization Algorithm (AVOA) with ANN to enhance the performance of damage identification models. AVOA is employed to optimize the weights and biases of the ANN model, thereby improving the model's accuracy in predicting both the location and severity of damages in bridge structures.

The proposed methodology involves two main stages. First, AVOA optimizes the initial parameters of the ANN, ensuring that the network is well-suited to the specific characteristics of the damage identification problem. Second, the optimized ANN is trained on a dataset of different simulated damage scenarios of a calibrated bridge structure. The results indicate that our hybrid approach demonstrates significant improvements in the precision and reliability of damage identification compared to traditional ANN models without optimization. The hybrid AVOA-ANN approach offers a robust and efficient solution for the accurate identification of structural damage, contributing to the advancement of SHM practices and the safety of critical infrastructure.

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