Cooperative Coevolution with Dynamic Species-Size Strategy for Vibration-Based Damage Detection in Plates

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***Abstract*—Vibration-based damage detection is based on the fact that vibration characteristics such as natural frequencies and mode shapes of structures are changed when the damage occurs. This paper proposes dynamic species-size strategy in cooperative coevolution concept. The resulting algorithm, cooperative coevolutionary genetic algorithm with dynamics species-size (CCGADSS), is used as the optimization algorithm in the vibration-based damage detection in plates. The objective function is numerically calculated from the difference between experimentally vibration characteristics and numerically evaluated vibration characteristics of the predicted damage. In finite element model for objective calculation, the plates are equally divided into 64 elements. There are 2 different cases with dissimilar occurred damage in plates are considered. In first case, the plate hase only one region consisting of 4 elements which are together connected and have same damage. In second case, there are 5 separated elements which are damaged differently. In order to demonstrate the performance of the dynamic species-size strategy, 3 optimization algorithms, which are genetic algorithm (GA), cooperative coevolutionary genetic algorithm (CCGA), and CCGADSS. The results indicate that CCGADSS is superior to GA and CCGA. Moreover solutions obtained using CCGADSS are quite close the actual damage. These results show that the dynamic species-size strategy can enhance performance of cooperative coevolution concept.**

***Keyworkds*—dynamic species-size strategy; vibration-based damage detection; genetic Algorithm; co-operative co-evolution; plate structure; finite element method.**

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