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Hybrid Intelligent Optimization Methods for Optimal Design of Horizontal-Axis Wind Turbine Blades

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Abstract : Designing the optimal shape of MW wind turbine blades is provided in a number of cases through evolutionary algorithms associated with mathematical modeling (Blade Element Momentum Theory). Evolutionary algorithms, among the optimization methods, enjoy many advantages, particularly in stability. However, they usually need a large number of function evaluations. Since there are a large number of local extremes, the optimization method has to find the global extreme accurately. The present paper introduces a new population-based hybrid algorithm called Genetic-Based Bees Algorithm (GBBA). This algorithm is meant to design the optimal shape for MW wind turbine blades. The current method employs crossover and neighborhood searching operators taken from the respective Genetic Algorithm (GA) and Bees Algorithm (BA) to provide a method with good performance in accuracy and speed convergence. Different blade designs, twenty-one to be exact, were considered based on the chord length, twist angle and tip speed ratio using GA results. They were compared with BA and GBBA optimum design results targeting the power coefficient and solidity. The results suggest that the final shape, obtained by the proposed hybrid algorithm, performs better compared to either BA or GA. Furthermore, the accuracy and speed convergence increases when the GBBA is employed

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