Abstract

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Blade Optimization Approach for a Vertical Wind Turbine

Harvesting electrical power from wind energy is a feasible solution for the issue of abundance energy. Blade is the wind turbines performance key. The research considered the design and optimization issue of blade's structure made from composite material. Genetic algorithm used as an optimization tool for defining different parameters in the blade fibre and matrix materials, fibre orientations, layer thickness, and number of layers for blade cross-section. Building an efficient genetic algorithm requires a good representation to the phenomenon through an appropriate definition of the fitness function. The presented approach aims to optimize the blade deign against different loads such as aerodynamic, inertia, and operating couples. Material model predicate all properties in principal directions. Force model analyze all external force-couple system. Stress and failure model evaluate all stress condition then check their values against material strength. Failure criterion determines whether the proposed model is safe not. All these parameters embedded into single fitness function to decide whether this model would replace one of the preceding generation not. New design parameters produced through crossover, mutation, and replacement processes until the algorithm converges. The results form presented approach is a design benchmark for blade material design and Selection process.