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ENHANCED PERFORMANCE OF HAWTS USING ADAPTIVE BLADES

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ASTRACT[1]

As the technology for HAWT development matures, more sophisticated techniques are being examined to increase annual energy capture. One such technique envisages the use of an adaptive or "smart" blade structure that could sense the wind velocity in some fashion and accordingly modify its aerodynamic configuration to improve performance. This could be achieved in either an active or passive manner, although the passive approach is much more attractive due to its simplicity and economy. As an example, a blade design might employ elastic coupling between flapwise bending, extension and twisting so that, as it bends and extends due to the action of the aerodynamic and inertial loads, it also twists in a manner to promote stall. Because of the premature stall condition, the length of the blade could be increased without overpowering the gearbox or generator, leading to an increase in energy capture. This work encompasses a feasibility study that focuses on aerodynamic performance computations wherein the blade geometry is artificially reconfigured as a function of wind speed. These computations identify the scope of the reconfigurations required for a 5-10 per cent increase in annual energy capture. Results show that increases of this magnitude can be achieved with a modest amount of blade twist (2 degrees). Follow-on work will investigate the design achievability of these reconfigurations and methods for fabricating selected concepts.

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