World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:9, No:06, 2015

Structural Performance Evaluation of Segmented Wind Turbine Blade Through Finite Element Simulation

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Abstract : Transportation of long turbine blades from one place to another is a difficult process. Hence a feasibility study of modularization of wind turbine blade was taken from structural standpoint through finite element analysis. Initially, a non-segmented blade is modeled and its structural behavior is evaluated to serve as reference. The resonant, static bending and fatigue tests are simulated in accordance with IEC61400-23 standard for comparison purpose. The non-segmented test blade is separated at suitable location based on trade off studies and the segments are joined with an innovative double strap bonded joint configuration. The adhesive joint is modeled by adopting cohesive zone modeling approach in ANSYS. The developed blade model is analyzed for its structural response through simulation. Performances of both the blades are found to be similar, which indicates that, efficient segmentation of the long blade is possible which facilitates easy transportation of the blades and on site reassembling. The location selected for segmentation and adopted joint configuration has resulted in an efficient segmented blade model which proves the methodology adopted for segmentation was quite effective. The developed segmented blade appears to be the viable alternative considering its structural response specifically in fatigue within considered assumptions.

Keywords : modularization, fatigue, cohesive zone modeling, wind turbine blade
Conference Title : ICMAME 2015 : International Conference on Mechanical, Aeronautical and Manufacturing Engineering
Conference Location : New York, United States
Conference Dates : June 04-05, 2015