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Evaluation of Design Concepts for Adaptive Wind Turbine Blades

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Abstract

The objectives of this work were to develop conceptual structural designs for an adaptive (bend-twist coupled) blade, to evaluate candidate design concepts, to identify constraints and/or concerns for manufacturing, load paths, and stress concentrations, to develop estimates of structural performance and costs, and to select a single configuration as showing the greatest potential for success in manufacturing, strength and durability.

This report summarizes the work performed on this project, including the approach taken, configurations and materials considered, and the computational methodology used. The work presented includes:

- Candidate fiber orientations and fabric architectures for adaptive blade manufacture are identified and assessed on the basis of estimated static strength, stiffness, and fabrication costs.
- A parametric study is performed for potential blade structural arrangements. Each configuration is evaluated on the basis of estimated manufacturing cost and magnitude of bend-twist coupling achieved.
- Based on the parametric study results, a single configuration is selected for further evaluation. A complete blade model is developed and assessed on the basis of estimated manufacturing cost and bend-twist behavior under steady loading.