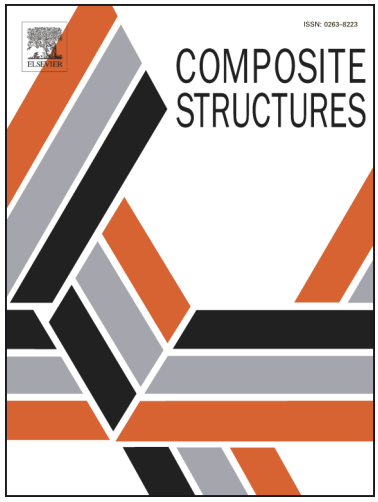

Fatigue failure of a composite wind turbine blade at its root end

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Fatigue failure of a composite wind turbine blade at its root end

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Abstract

As blade failures at wind farms have increased, the structural safety of composite wind turbine blades is ever more important. The recent implementation of considerably larger blades has made the problem even more crucial. One of the critical failure modes is the blade root failure, which can result in the blade being pulled out from its wind turbine during operation. In this study, we experienced delamination failure at the blade root during fatigue testing of a 3MW full-scale wind turbine blade according to international standard IEC 61400-23: Full-scale structural testing of rotor blades. Comparing the measured data with the FE analysis results, we simulated the situations the blade had experienced, and then found what caused the delamination failure as well as the problem of the conventional design approach. The bumping motions of the blade shell caused by geometric complexities between the maximum chord and the root alter significantly the load distribution at the end of the blade root. Therefore, to enhance the structural safety of a large composite wind turbine blade, a more detailed FE analysis on the blade root in the design stage is needed.

Keywords: Fatigue; Failure; Delamination; Wind turbine blade; Bumping motion

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