Structural Analysis of Offshore Wind Turbine Blade Under Extreme Climatic Conditions Using FEM

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Résumé

The production of electricity, is today at the heart of an energy and environmental transition. Electricity production in the world is in fact, the most emitting sector of CO2 due to the use of fossil fuels (mainly coal). Wind energy, based on its predictability and availability, is one of the most promising sources of renewable energy in the world, it does not require fossil fuel, its operating cost is low, and it avoids the rejection of large masses of greenhouse gases in the atmosphere. Wind turbine blades are highly complex structures with complex three-dimensional forms governed by their aerodynamics that allow a maximum of power output and efficiency. They are subjected to aerodynamic, centrifugal and gravity loads, which impose large fatigue stresses on the moving rotor, notably at the transition region of the blade. Considering the maintenance cost for renewable marine energies (RME), durability and stiffness are essential for the offshore wind turbine blades (OWTB) and it is within this framework that our study will be focused. In the present work, a numerical study has been conducted using ABAQUS FEA Software to identify the sensitive zones and the most critical failure mechanisms on a large composite OWTB under extreme climate conditions "Typhoon" to get an understanding of the complex structural behavior of wind turbine blades and to evaluate the potential of composite materials for RME applications.

Mots-Clés: Wind turbine blades, FEA, DLOAD, Aerodynamic, Composite Materials, Sensitive Zones, Damage, Failure.

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