Structural Optimization of an Innovative 10 MW Wind Turbine Nacelle - DTU Orbit (05/12/2018)

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For large wind turbine configurations of 10 MW and higher capacities, direct-drives present a more compact solution over conventional geared drivetrains. Further, if the generator is placed in front of the wind turbine rotor, a compact “king-pin” drive is designed, that allows the generator to be directly coupled to the hub. In presented study, the structural re-design of the innovative 10 MW nacelle was made using extreme loads obtained from a 10 MW reference wind turbine. On the basis of extreme loads the ultimate stresses on critical nacelle components were determined to ensure integrity of the structure. Farther, the tower top mass was reduced on the basis of the topology optimization results with compliance limits applied for the king-pin and mainframe. Presented analysis shows that a structural mass of the nacelle can be reduced without significant influence on the mechanical properties of the load caring elements. The total weight of the nacelle after mass reduction is 24 % lower than for the initial design.

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