On wind turbine down-regulation control strategies and rotor speed set-point

The use of down-regulation or curtailment control strategies for wind turbines offers means of supporting the stability of the power grid and also improving the efficiency of a wind farm. Typically, wind turbine derating is performed by modifying the power set-point and subsequently, the turbine control input, namely generator torque and blade pitch, are acted on to such changes in the power reference. Nonetheless, in addition to changes in the power reference, derating can be also performed by modifying the rotor speed set-point. Thus, in this work, we investigate the performance of derating strategies with different rotor speed set-point, and in particular, their effect on the turbine structural fatigue and thrust coefficient were evaluated. The numerical results obtained from the high-fidelity turbine simulations showed that compared to the typical derating strategy, the derated turbines might perform better with lower rotor speed set-point but it is crucial to ensure such a set-point does not drive the turbine into stalled operations.