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Operation and Equivalent Loads of Wind Turbines in Large Wind Farms[1] SOREN JUHL ANDERSEN, JENS NORKAER SORENSEN, ROBERT FLEMMING MIKKELSEN, Tech Univ of Denmark — Wind farms continue to grow in size and as the technology matures, the design of wind farms move towards including dynamic effects besides merely annual power production estimates. The unsteady operation of wind turbines in large wind farms has been modelled with EllipSys3D(Michelsen, 1992, and Sørensen, 1995) for a number of different scenarios using a fully coupled large eddy simulations(LES) and aero-elastic framework. The turbines are represented in the flow fields using the actuator line method(Sørensen and Shen, 2002), where the aerodynamic forces and deflections are derived from an aero-elastic code, Flex5(Øye, 1996). The simulations constitute a database of full turbine operation in terms of both production and loads for various wind speeds, turbulence intensities, and turbine spacings. The operating conditions are examined in terms of averaged power production and thrust force, as well as 10min equivalent flapwise bending, yaw, and tilt moment loads. The analyses focus on how the performance and loads change throughout a given farm as well as comparing how various input parameters affect the operation and loads of the wind turbines during different scenarios.

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