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Power Optimization of Wind Farms in Large Eddy Simulations¹ JOHAN MEYERS, JAY PRAKASH GOIT, Mechanical Engineering, KU Leuven, Celestijnenlaan 300A, B3001 Leuven — As the understanding of wind-farm aerodynamics broadens, our interest is shifting towards exploring the possibilities of optimising and improving the power-extraction of a wind farm. In the present work we couple flow simulations performed using Large Eddy Simulations (LES) with gradient based optimization to control individual turbine in a farm, so as to achive an increase in the total power. The controls in our optimization problem are the thrust coefficients $C'_{T,n}(t)$ of individual turbines as function of time. We use a gradient-based algorithm for the optimization and the gradients are computed using the adjoint method. In the first step we verify the adjoint calculated gradient by comparing it to the forward simulation based gradient obtained from finite difference of the cost function and find that errors remain below 5%. We further elaborate the optimization techniques, and present results for a number of cases of wind-farm boundary layer cases. We also discuss how the thrust coefficient $C'_{Tn}(t)$ evolves with time for different turbine locations. We also present and interpret results of the adjoint fields.

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