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Performance of a wind turbine over a ridged terrain[1] CHRISTIAN SANTONI, UMBERTO CIRI, STEFANO LEONARDI, The University of Texas at Dallas — Performance of wind turbines is affected by their interaction with the topography. Low momentum flow from the terrain may impinge the turbine resulting in fatigue loads that may reduce durability. However, at the same time it may promote the transport of momentum and kinetic energy into the wake improving the power production on the downstream turbines. In order to address how the topography affects the flow, Large Eddy Simulations of a wind turbine located on a wavy surface are performed. The height variation of the topography is described by a sinusoidal wave. Two different amplitudes were considered, $0.10D$ and $0.05D$, where D is the rotor diameter. The wavelength has been kept constant to $3D$. The effect of the relative position of rotor and terrain geometry was assessed by placing the turbine either at the crest or at the trough of the undulated wall. NREL-5MW turbine blades were modeled using the actuator line model whereas the tower, nacelle and topography using the immersed boundary method. A simulation of a wind turbine on a flat terrain was performed as reference case. The performance of the turbine was evaluated in terms of the power production and blade load fluctuations, as well as for the energy entrainment into the wake of the turbine.

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