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NUMERICAL INVESTIGATIONS OF WIND TURBINES ON A SLANTED WALL

The objective of the present investigations was to identify the fundamental aerodynamic issues of residential wind-power systems based on rooftop wind panels with horizontal rotors. Numerical investigations were performed for (a) a single high efficiency wind turbine placed in a cross flow, (b) a model roof-top placed in a cross flow, and finally, after the identification of the optimum roof-top location for placing the wind turbine, (c) simulations of the roof-top panel with multiple horizontal rotors. Numerical results are presented for two cases of wind turbine blades being aligned or at 90 degrees (perpendicular) with the wind direction. When the blade is at 90 degrees with the wind direction, there are areas of high wind velocity, vorticity and turbulent kinetic energy with high pressure in front and low pressure in the back which during rotation creates oscillatory flow, impinging on the roof, resulting in high stress regions with potential structural damage. However, when the blade is aligned with the wind direction, the effects are less severe. Results for a two-turbine panel configuration shows when the downstream turbine is offset by 1-D in both streamwise and vertical directions, the combined power output of the two turbines exceed the summation of the two single roof-top turbines.

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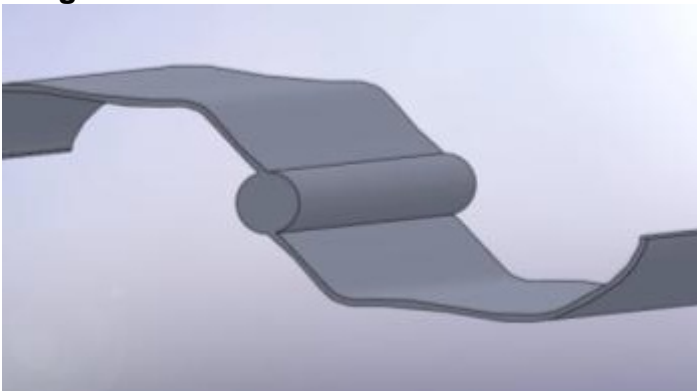
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