Graduate Seminar

Speaker

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A numerical study of atmospheric turbulence around wind farms

Abstract:

Wind energy is clean, cost effective, and one of the fastest growing (currently at ~24% per year) energy sources worldwide. About 75% of the global wind power is installed in Europe, North America, and China. Canadian wind industry has the potential to be a leader in satisfying world's demand for renewable energy. Atmospheric turbulence in cold climate is a major challenge for Canadian wind energy industry. It is difficult to generate a realistic atmospheric turbulence in laboratory experiments, and thus, numerical simulations provide useful feedback to wind industry.

In this talk, I will discuss a Large Eddy Simulation (LES) study of atmospheric turbulence around an array of wind turbines. The results of this study indicate that a cold atmosphere has the potential of producing 10% higher electricity than other regions, and on-shore wind turbines in the wake behind other turbines can produce 40% more energy than off-shore wind turbines. Cost analysis also suggests that on-shore wind energy is 50% less costly than off-shore wind energy. The talk will discuss the mathematical and numerical formulation of the LES study, as well as the overall impacts of the icing condition and the availability of de-icing techniques.