

# SAFL SEMINAR SERIES

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ST. ANTHONY FALLS LABORATORY ~ AUDITORIUM

## Fundamental problems in wind and hydrokinetic energy.



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*Abstract:*

Wind power is one of the most abundant and easily accessible sources of clean and renewable energy on the planet. In line with wind power another promising renewable energy source that is gaining acclaim is the guaranteed flow of river, tidal, and ocean currents. These can be converted to energy via marine hydrokinetic devices and has an incredible potential to fill the ever increasing demand for energy. In spite of the valuable efforts to date, fundamental problems related to the flow and structure interaction, scale dynamics, power maximization, structural reliability, environmental assessments, among others, persist. Continued research geared towards properly addressing these issues is necessary if we are to efficiently expand and capitalize on these vast sources of energy.

In the first part of this presentation, I will present some of the most recent insights obtained from wind tunnel experiments carried out at St. Anthony Falls Laboratory. This research included uses of different sizes and numbers of model wind turbines. The focus of these tests was placed on understanding the complex mechanisms of the flow/structure interaction; tip vortices stability, drag reduction, scalability of the problem.

Secondly I will present preliminary research collected on hydrokinetic turbines. The focus of this research is placed on the conceptual similarities and differences of the hydrokinetic turbines and their wind counterparts, and the turbine's unsteady response with energetic coherent turbulent structures.

In conclusion these studies have provided valuable information pertaining to the turbulent flow/structure interaction needed to improve the design of wind and hydro turbines. Also, this information is being used to test and guide the development of improved parameterizations of wind turbines in high-resolution numerical models, such as large-eddy simulations (LES). The applications of this research are far reaching and important in increasing the viability and production of wind and hydrokinetic turbines, an increase that is necessary if they are to be implemented on a large enough scale to significantly generate a portion of the energy needed.