Sink or Swim: Control of Floating Offshore Wind Turbines

Professor Lucy Pao

Colorado Boulder

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Abstract:

Wind energy is among the fastest-growing sources of electrical energy worldwide. Compared to land-based wind energy, offshore wind energy has the advantages of increased wind resource availability and consistency, proximity to major population centers, and enabling larger-scale turbines. As such, over the last decade, installed offshore wind power capacity has grown at a phenomenal average rate of 33% per year. Currently, more than 99% of installed offshore wind capacity consists of fixed-bottom wind turbines in shallow waters (<60m deep). Globally, however, the majority of offshore wind resources are over water depths greater than 60m. Floating wind turbines are better suited in such deep waters. Though, compared to fixed-bottom wind turbines, floating wind turbines are more dynamic and exhibit potential instabilities, which require advanced control methods to ensure a safe and efficient operation. Beyond their existing objectives of maximizing power production while minimizing structural loads, floating wind turbine controllers must also avoid large platform oscillations and accommodate ocean wave and current disturbances. In this talk, I will provide an overview of the challenges and opportunities in the control of floating offshore wind energy systems. I will also summarize some of our recent work in developing and analyzing multi-loop feedback control approaches aimed at improving power quality, regulating the generator speed, and/or mitigating structural loading.