a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

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MECH 493 project: Model reduction of a floating offshore wind farm wake model

Background and research goal

Floating offshore wind farms have a great potential in generating electrical power in a clean and sustainable manner. Despite this potential, one challenge to prevent them from prevailing is their extremely high cost in construction, installation, maintenance and operation. Wind farm modeling and control are hot research topics to tackle such challenge.

The research goal is to obtain a control-oriented reduced-order wake model for a floating offshore wind farm. There are existing wake models which account for dynamic behavior of wind farm, such as FLORIDyn (for onshore wind farms) and FLORIDynFloat (for floating offshore wind farms). But these models typically use thousands of states to represent the wind farm dynamics. Using some model reduction techniques such as the Eigensystem Realization Algorithm, the high-order models are approximated by low-order ones which can be appropriate for model-based controller design.

Tasks to be performed by the student

1. Linearize the nonlinear FLORIDyn and FLORIDynFloat models at various operating points (wind speed, wind farm layout, control inputs).
2. Apply model reduction techniques to linearized models. Possibly parameterize the reduced models in terms of the operating point.
3. Analyze the results. (Model simplicity vs. model accuracy)

Facilities and team:

The student will work with Dr. Ryozo Nagamune and his PhD student Mr. Ali Cherom Kheirabadi.