Control Co-Design of Floating Wind Turbines and Flexible Drones

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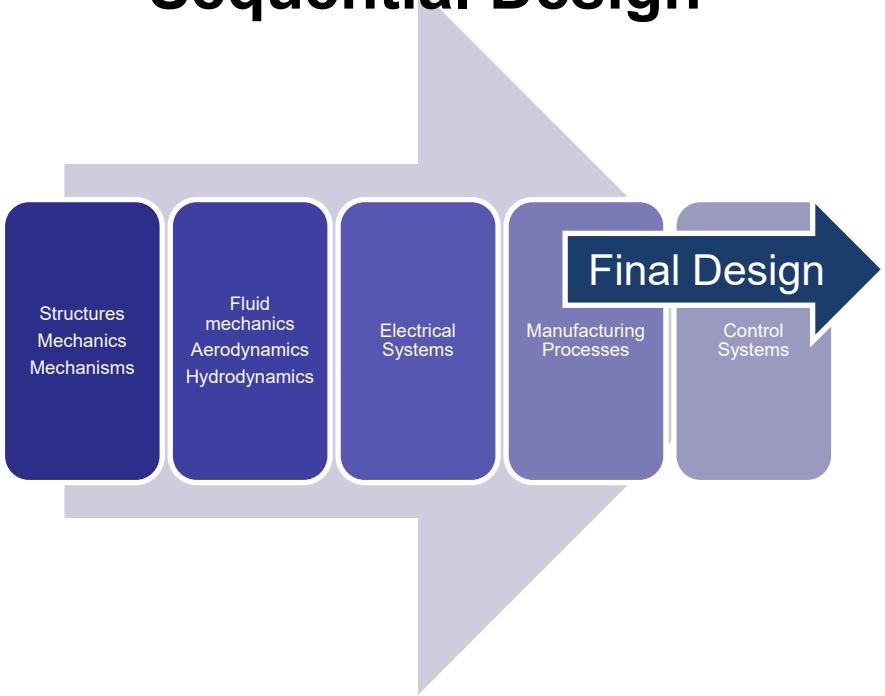
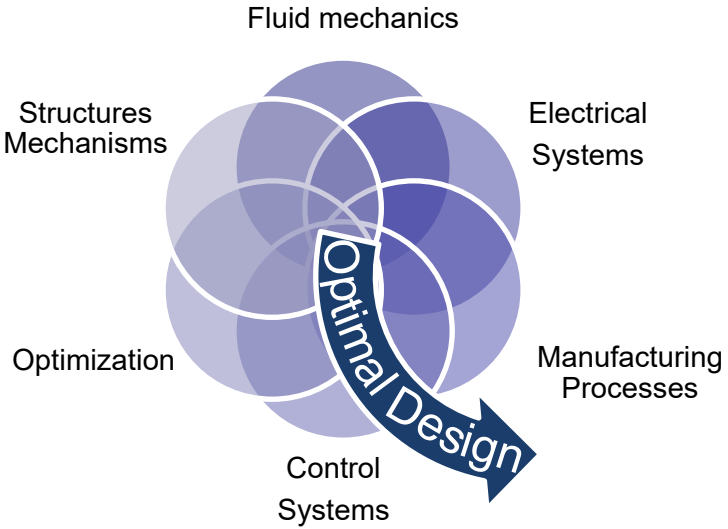
Introduction

Sequential Design



Control Co-Design



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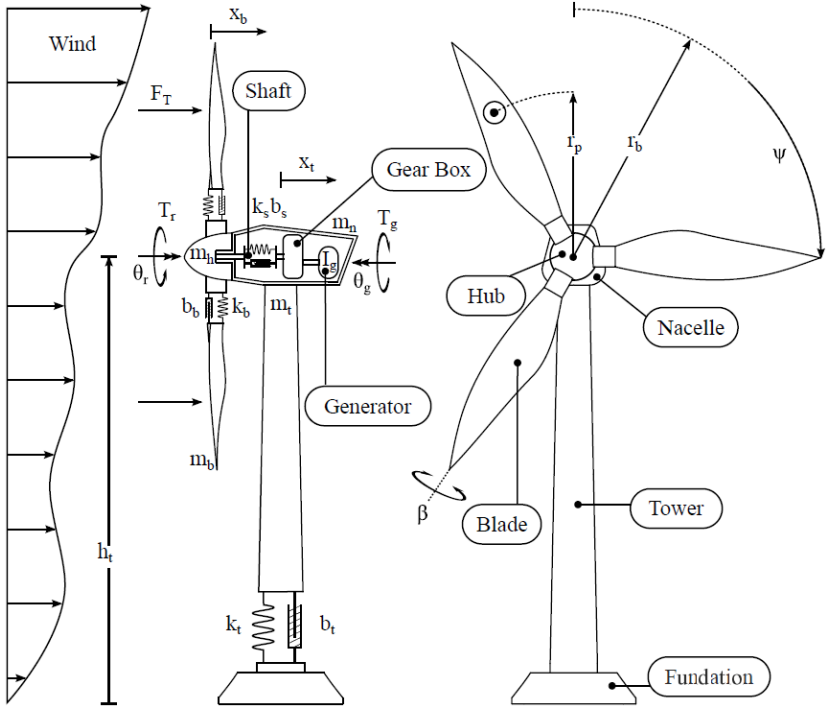
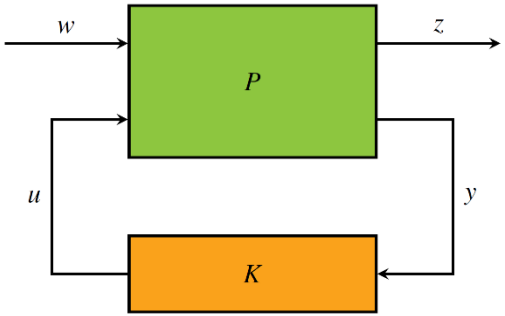
Wind Turbine Control Co-Design

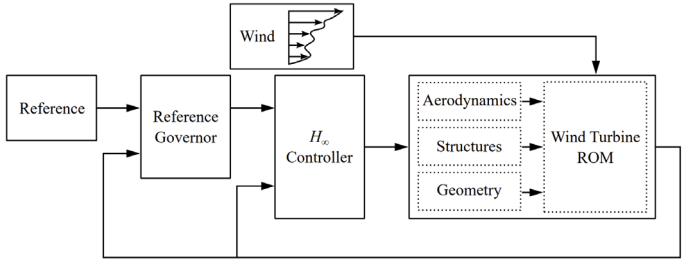
Assumed model of the wind turbine including the rotor, the drive-train, the generator, and the tower



Closed loop system configuration for the structured H∞ problem formulation



Reference Governor applied to closed loop system



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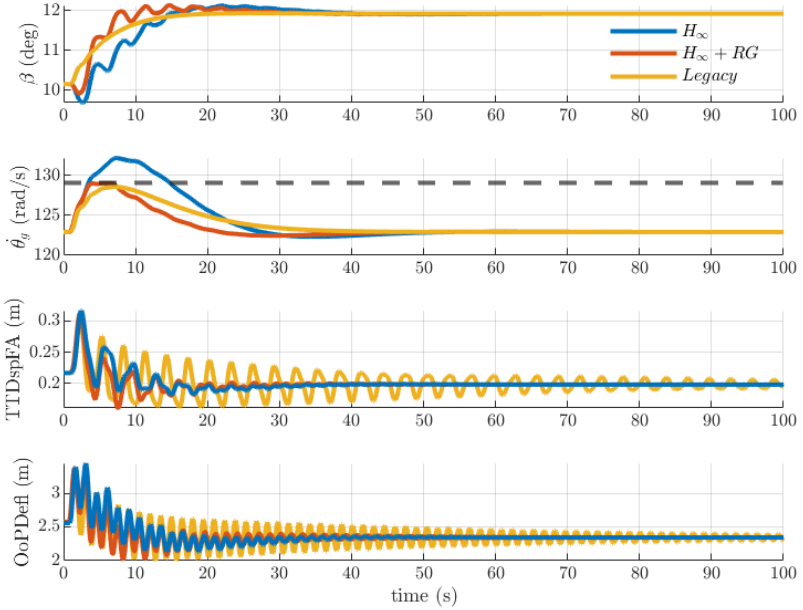
Results

Design controller and thickness of the tower

$$\begin{aligned} \underset{K,t}{\text{minimize}} \quad & J = \text{RMS}(\delta\dot{\theta}_g) \cdot M/M_0 \\ \text{subject to} \quad & 0.5 \le t/t_0 \le 1.5, \\ & \text{TV}(TTDspFA) \le 0.65 \end{aligned}$$

- H∞ controllers can efficiently mitigate the vibrations of the structure and reduce the fatigue of the tower.
- RG can be combined with the H∞ controller to reduce the overshoot. When the RG is applied, we reduce the RMS of the generator speed error

Time response to a 1-m/s step input in wind speed for the land-based wind turbine



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Publications

- J. Lopez Muro, X. Du, J.-P. Condomines, O. Bilgen and L. Burlion Wind Turbine Tower Thickness and Blade Pitch Control Co-Design Optimization. AIAA SCITECH 2022 Forum.

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Thank you for listening!
Questions?

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