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Control and Dynamics of WECs
Brief overview

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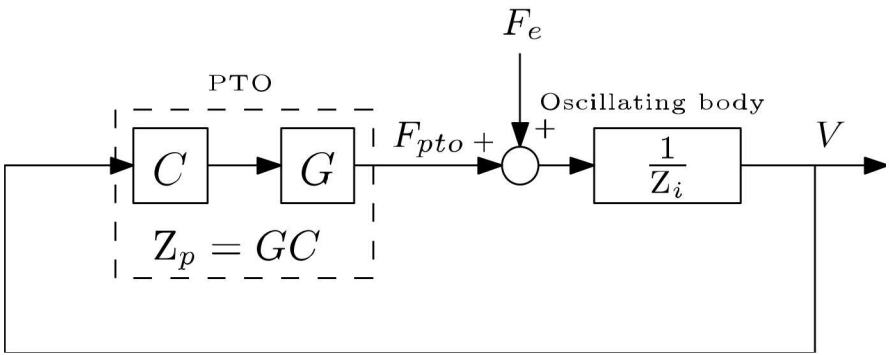
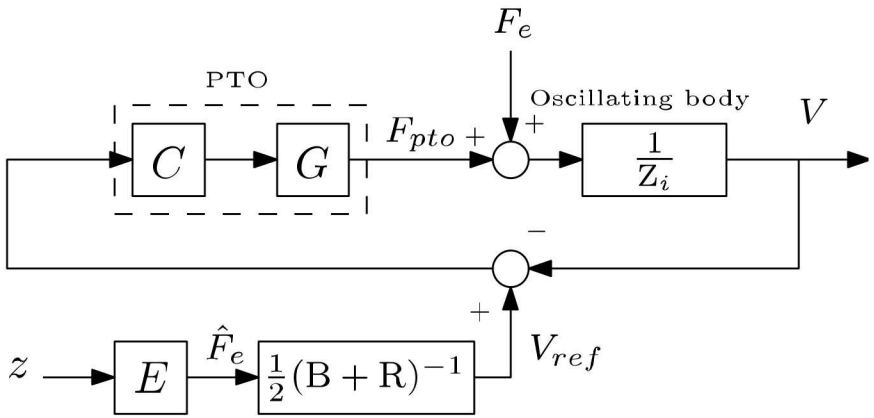
The WEC control problem: The two classical approaches

Impedance matching



Velocity tracking



C = controller

G = PTO dynamical model

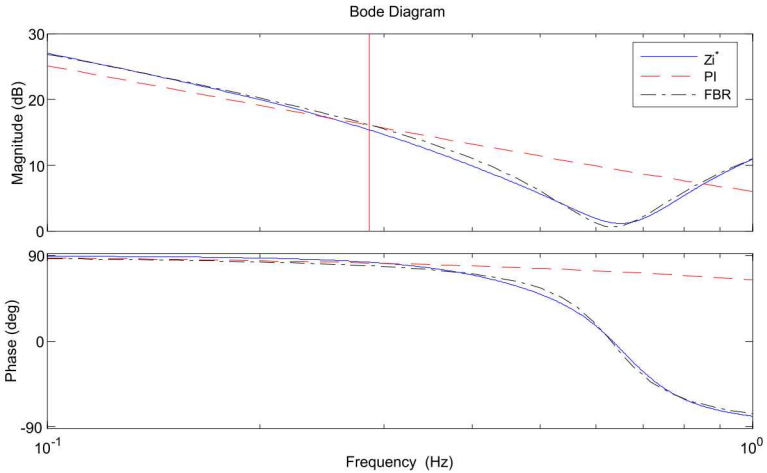
Z_i = WEC dynamical model (impedance)

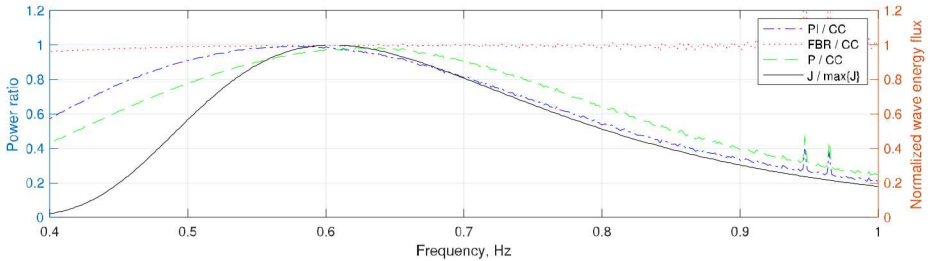
E = estimator (excitation force)

z = measurements (acceleration, pressure, waves…)

Wave predictions: where does the issue originate from? How can we address it?

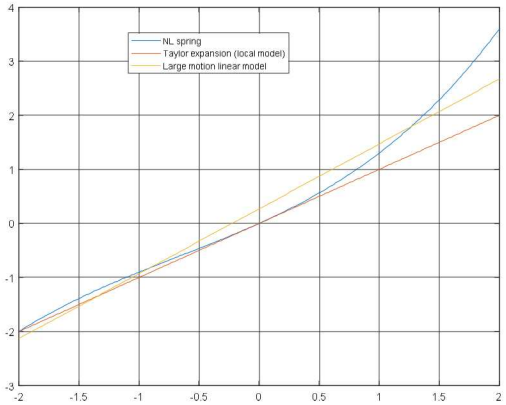
- Why?
  - Optimal feedback law for power maximization is acausal
- How to address the issue in practice?
  - Approximate optimal transfer function in a limited frequency range with as low order causal controller

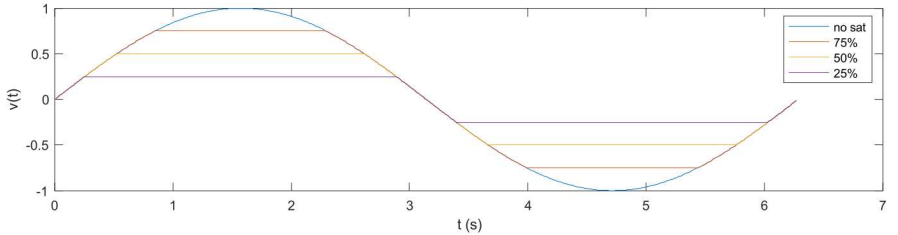


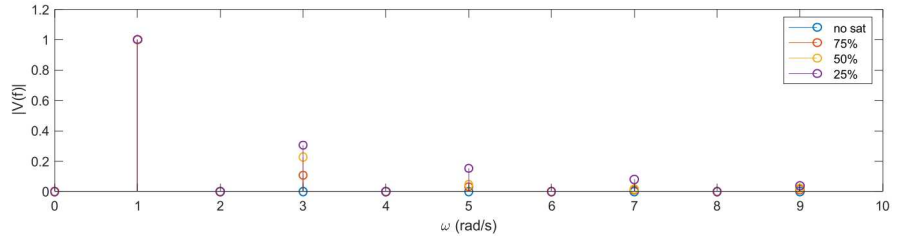


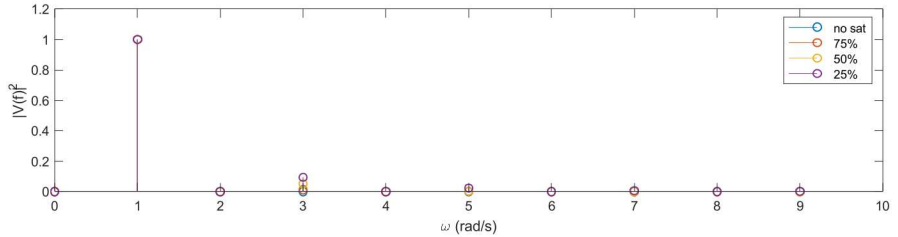
Nonlinearities: how do they affect the design of the controller?

- There are nonlinearities in the system (every real system)
- Best linear approximation



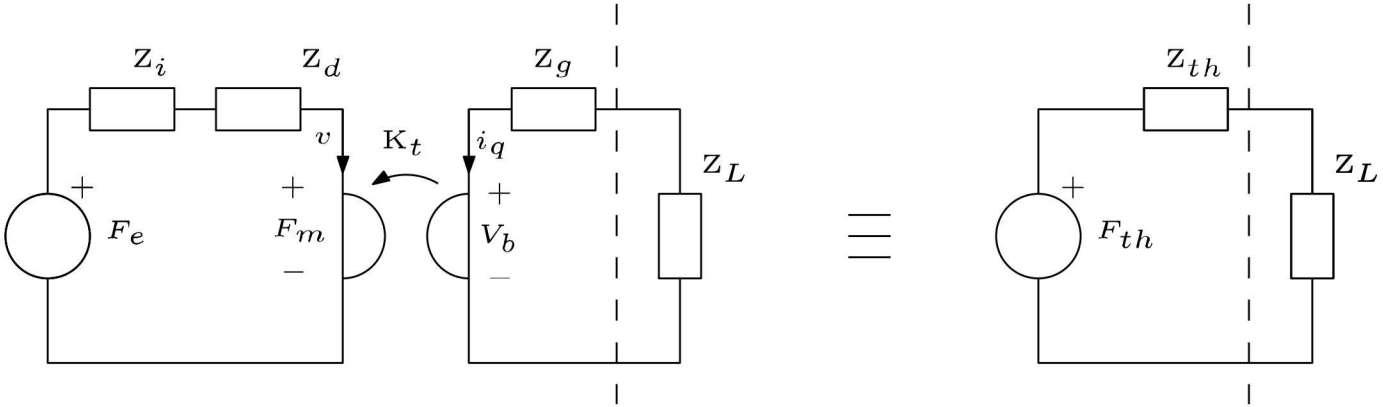




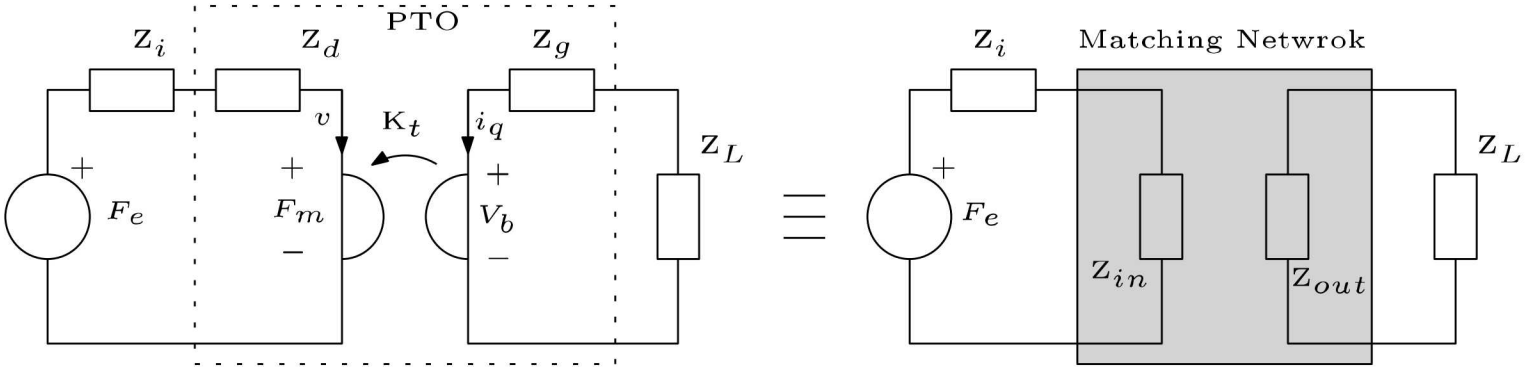


Maximizing electrical power: how does the control problem change?

- If the controller is designed to maximize mechanical power:
  - Resulting Electrical (useful) output power may not be optimal (it may be negative)
- Maximize electrical power:
  - Define equivalent impedance including PTO dynamic



Control co-design:
how to improve overall device design



Thank you

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