Discrete Electromechanical Oscillation Control (DEOC)

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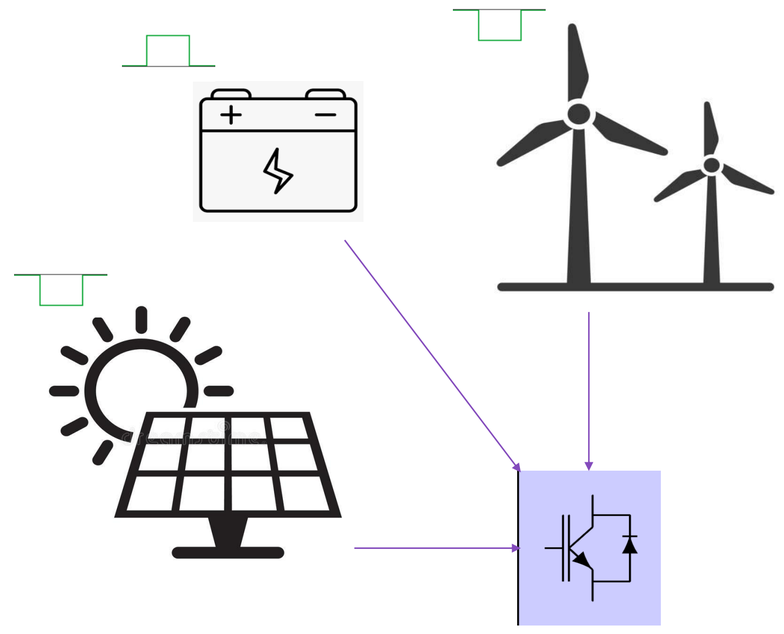
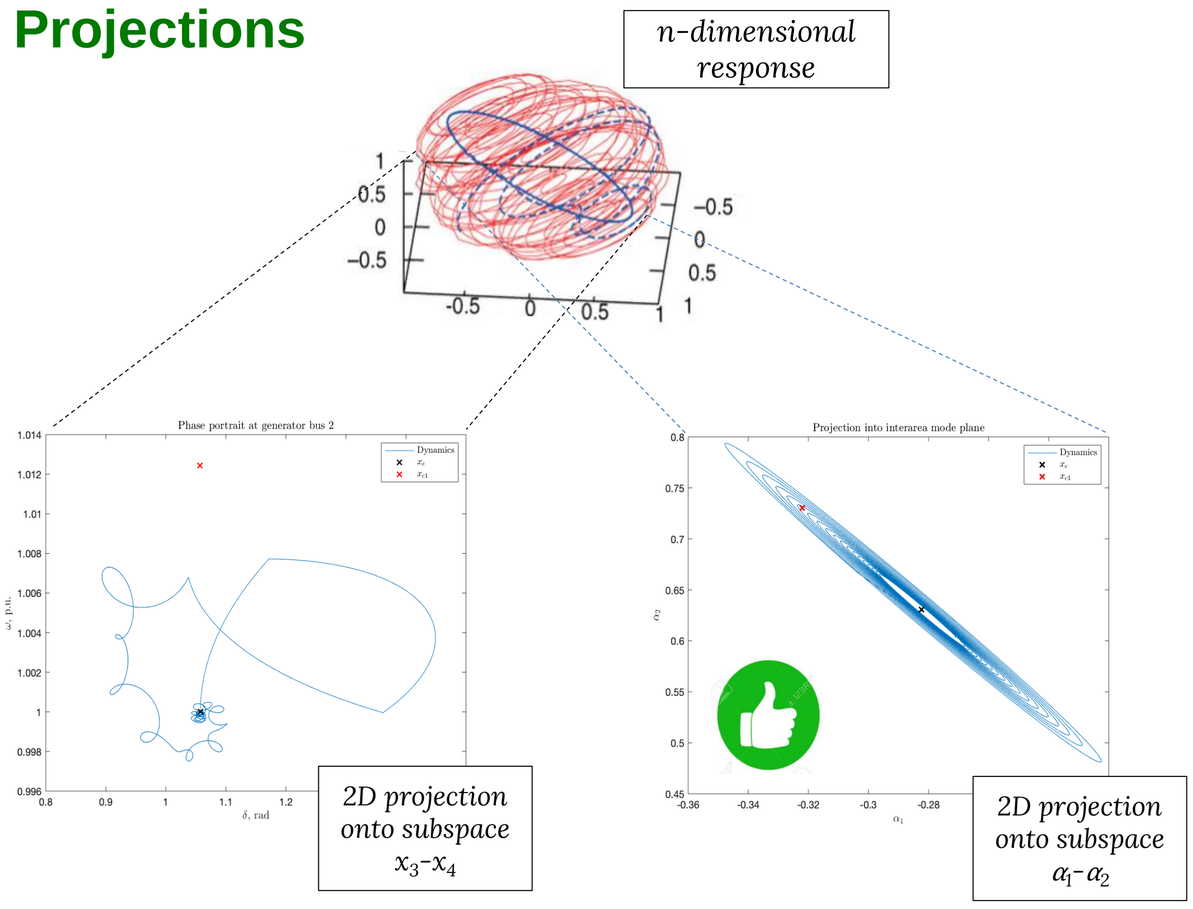
Main idea

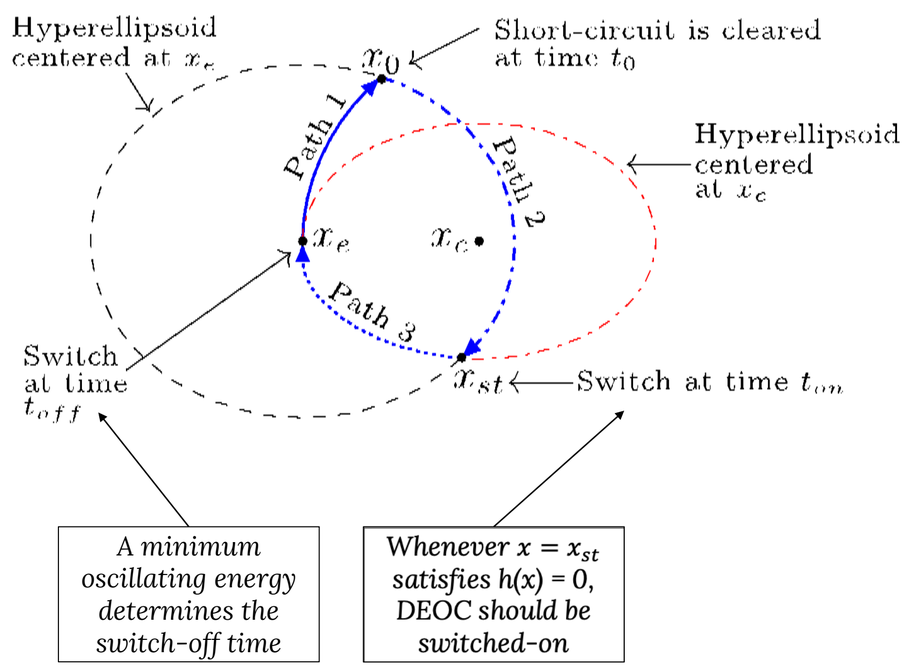
- Use controllable components to **change the dynamical trajectory** of an oscillatory behavior by injecting/absorbing active power through step-wisely controlled elements.
- **Restore the initial equilibrium point** at a determined time to significantly reduce the oscillation amplitude.
- Three main variables to determine:
  - ΔP: to switch the eq. point form x_e to x_c
  - t_{on}: to activate the switched operation
  - t_{off}: to deactivate the switched operation



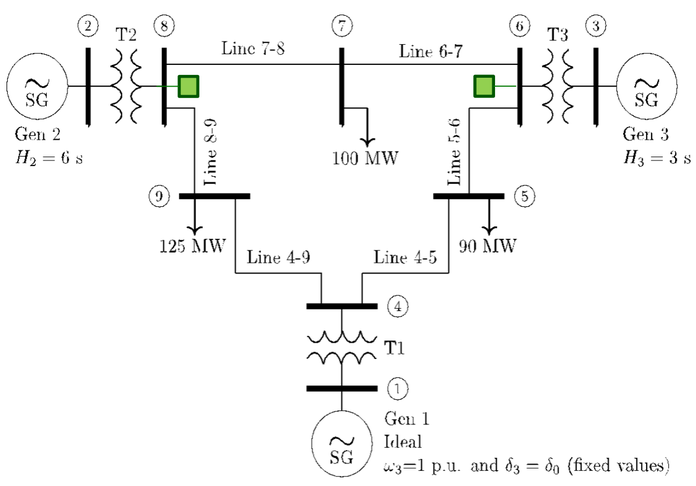
Projections

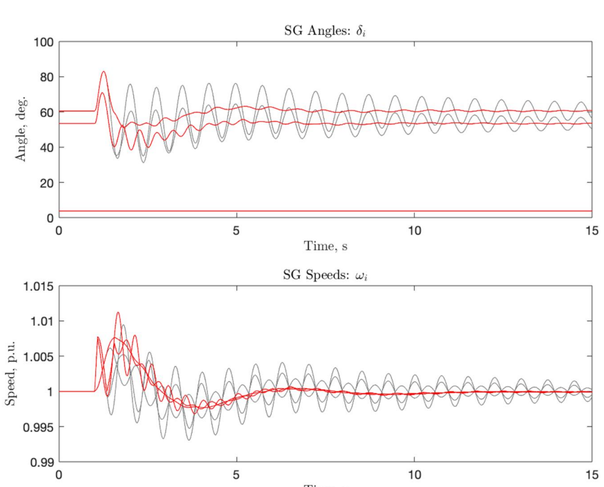


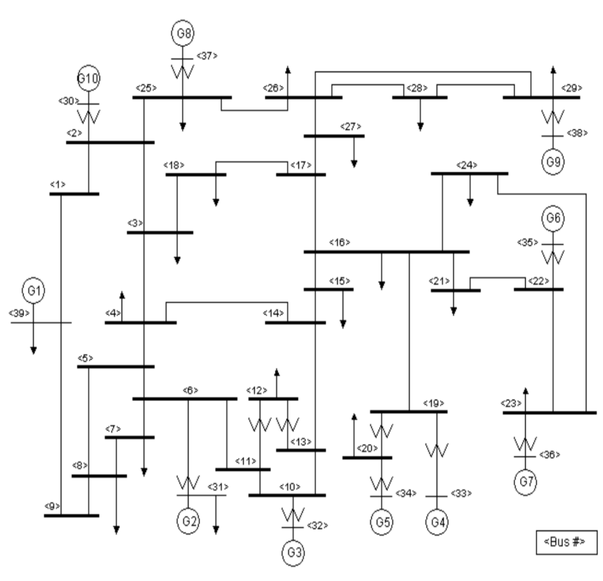
Switching Conditions

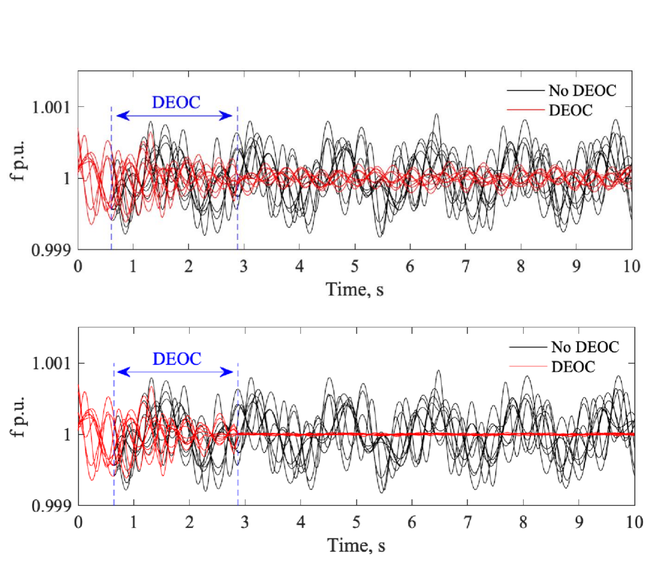


Validation









Remarks

- **DEOC in multi-modal systems**
  Progressive mode annihilation based on projections is used to handle multiple dominant modes.
- **Proof of concept**
  Simulations have shown effective reduction of oscillation amplitude.
- **Subset of controllable components**
  Injection/absorption of active power at some selected buses suffice to handle oscillations.

References

[1] S. Martinez-Lizana and H. Pulgar-Painemal, "*Addressing grid nonlinearities in discrete electromechanical oscillation control*," in 2023 North American Power Symposium (NAPS), 2022, pp. 1–6.

[2] H. Pulgar-Painemal and S. Martinez-Lizana, "*On the Search for Expanded Grid Control Capabilities: Discrete Control on Emerging Power Technologies*," in IEEE Transactions on Power Systems, vol. 38, no. 1, pp. 984-987, Jan. 2023.

[3] S. Martinez-Lizana and H. Pulgar-Painemal, "*Further advances on discrete electromechanical oscillation control*," in 2022 North American Power Symposium (NAPS), 2022, pp. 1–6.