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# Damping of Inter-Area Oscillations via Modulation of Aggregated Loads

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Felipe Wilches-Bernal[1], Raymond H. Byrne[1], Jianming Lian[2]

[1]Sandia National Laboratories

[2]Pacific Northwest National Laboratory,

✉ E-mail: fwilche@sandia.gov

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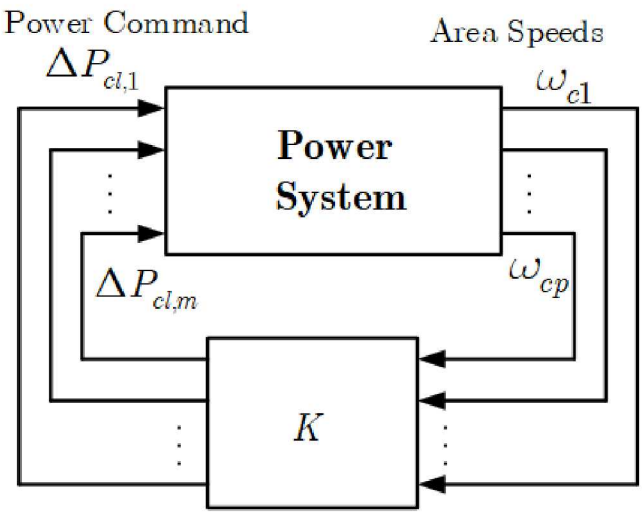
# Approach

- Control approach: modulate loads to enhance the small-signal stability of the system (damp inter-area oscillations)
- Aggregate loads into clusters such that each cluster has some impact on the system's oscillatory dynamics.
- System identification was used to determine the effect of the load clusters in the system's dynamics. It was performed by probing the system with the load clusters.



# Approach

- Control law for optimal output feedback

$$u(t) = Ky(t)$$

- The optimal gain is $K \in \mathbb{R}^{m \times p}$

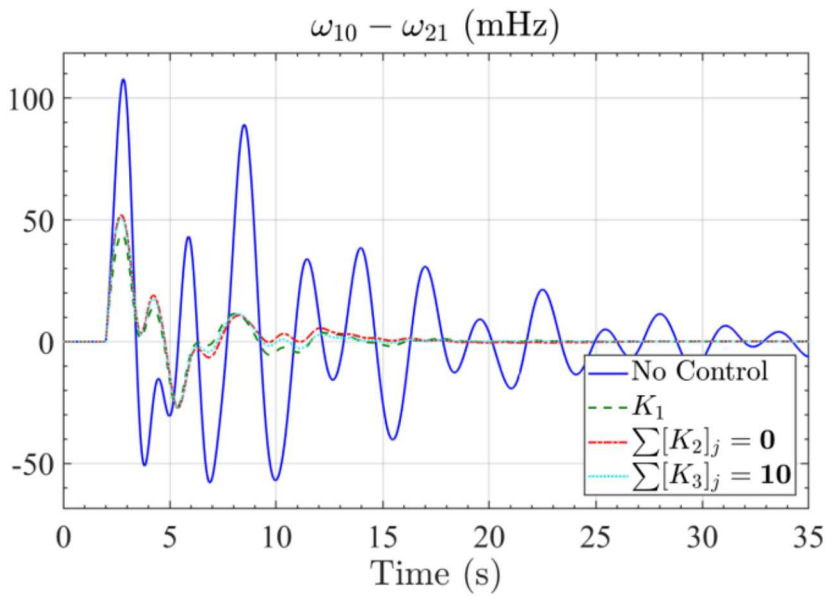
- Optimal gain is

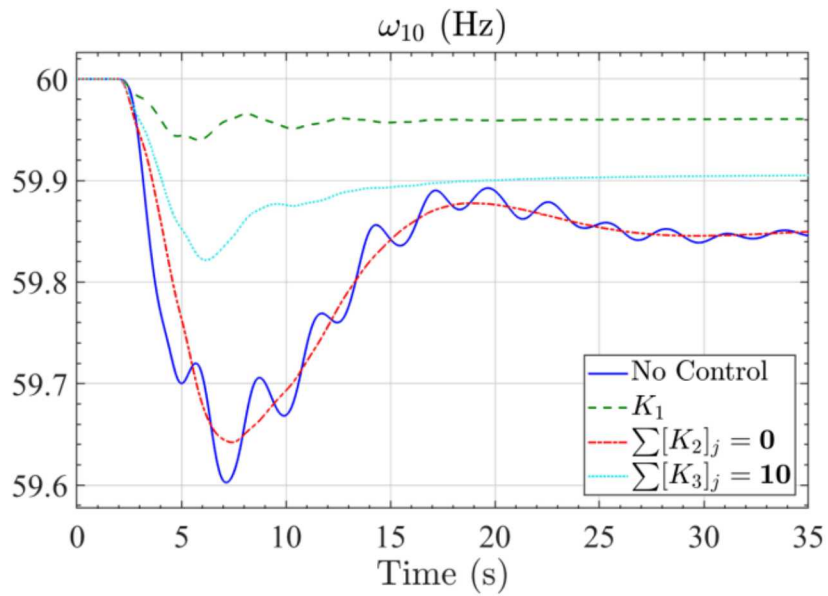
$$K = \begin{bmatrix} k_{11} & k_{12} & \dots & k_{1p} \\ k_{21} & k_{22} & \dots & k_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ k_{m1} & k_{m2} & \dots & k_{mp} \end{bmatrix}$$

- The sum of the rows of $K$ represents the **droop gain (steady state action)** for a particular actuator

# Results

- Results for a loss of generation event in a representative power system.



# Conclusions

- Load can effectively be used as an actuator to damp inter-area oscillations in power systems.
- Aggregating loads is important to achieve dynamic effects on the system with small load modulation.
- Proposed solution ensures a controller that provides inter-area oscillation damping while being inactive to steady-state or global frequency deviations.
- Wide-area information is important in the control design