Paper No: 17PESGM0664

SAND2017-7356C

Sandia National Laboratories

Effect of Time Delay Asymmetries in Power System Damping Control

Ricky Concepcion

Sandia National Laboratories

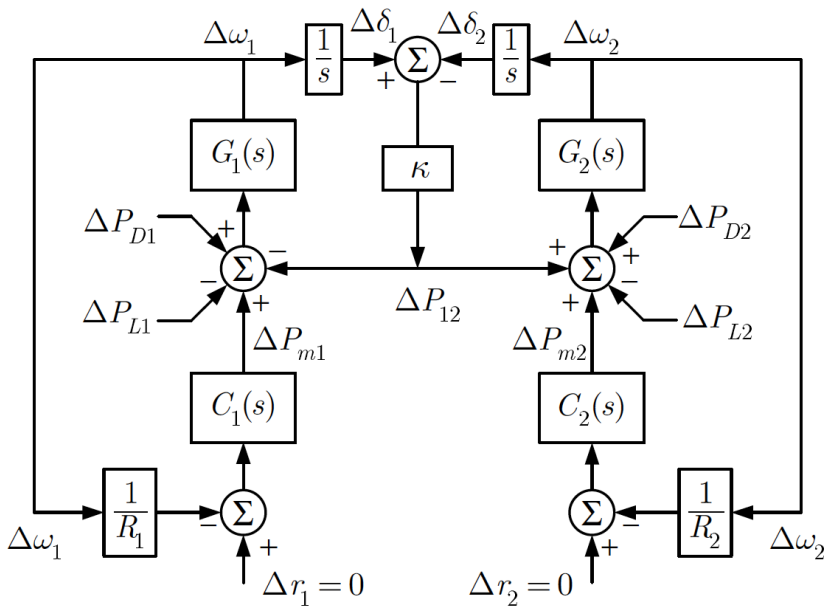
rconcep@sandia.gov

IEEE PES Power & Energy Society®

IEEE

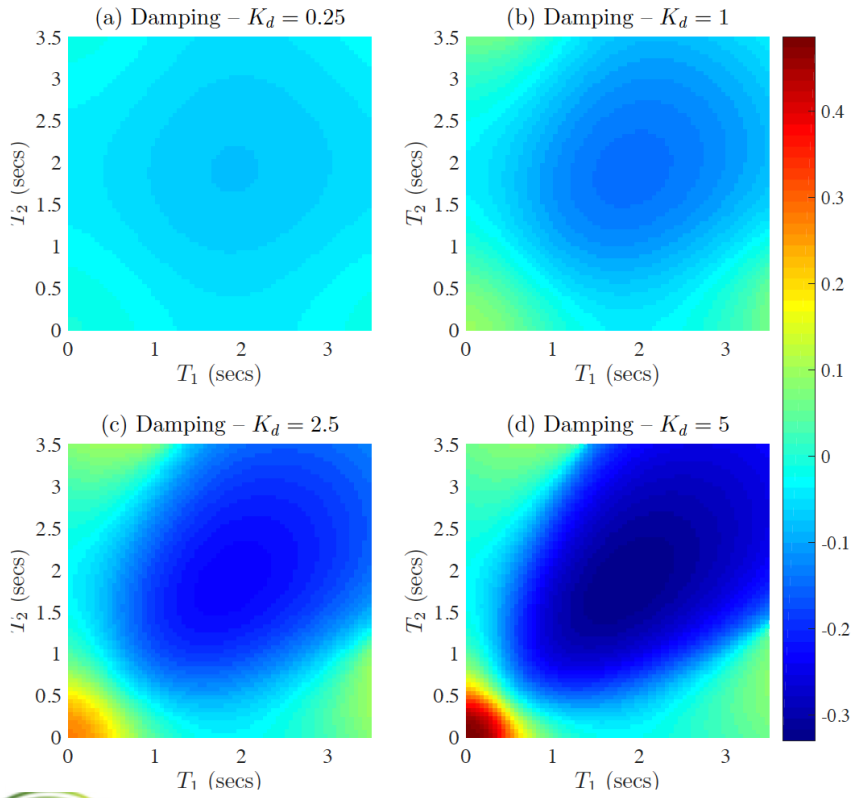
Background

- Motivated by the Pacific DC Intertie (PDCI) wide area damping controller project
  - Controller uses PMU data from the north and south ends of the PDCI to generate a command signal for power modulation
- What is the impact on the controller/system performance when this data arrives at different times?
- Expected that time alignment of PMU data (e.g., make delays symmetric) would improve controller performance

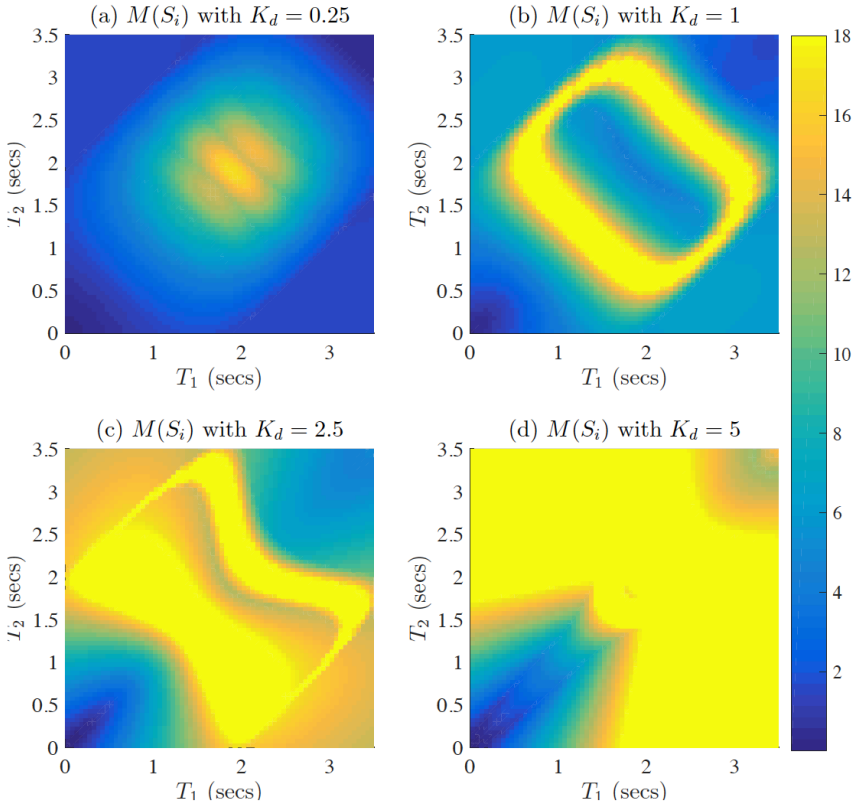


Results

Increasing latencies independently destabilizes the system… but increasing them jointly has a larger impact.



Increasing latencies makes the system more sensitive to disturbances in general.



Conclusions/Recommendations

- Increasing the proportional gain stabilizes the system when delays are small, but destabilizes the system when they are large
- Increases in individual latencies have a lesser destabilizing effect by comparison
- Larger time delays reduce the ability of the system to reject load disturbances
- Because communication latency is random in practice, future research should analyze the impact of stochasticity on system stability and robustness