Title: SRC Task 2111.003: Nonlinear Control of FACTS for Transient Stabilization

Duration: 2010-2013

Sponsor: Semiconductor Research Corporation

Contributing Faculty: Marija Ilic

Contributing Students: Milos Cvetkovic

Description:
This project was initiated in collaboration with ABB with the main objective of designing dynamical controllers for transient stabilization by the Flexible Alternating Current Transmission Systems (FACTS) devices. In particular, the controllers are required to guarantee interconnected system stability against large disturbances, including faults and equipment failures, and sudden large deviations in power generated by the renewable resources.
We have shown that controller performance depends to a large extent on the dynamical model used and on the choice of the control objective. With that in mind, we introduced an approach to power system modeling which preserves the relevant fast dynamics of FACTS and other components. The new model allowed us to design controllers which react much faster than the controllers previously proposed in the literature. This model feature brought us significant performance improvement measured in shorter transients. Additionally, we chose a control objective particularly suitable for transient stabilization using FACTS. Such novel control objective enables the controller to accumulate energy of disturbances. This feature aligns well with physical characteristics of FACTS devices which cannot generate or dissipate energy. This choice of control objective enables stabilization of larger disturbances than was previously possible.
Finally, we proposed a two-level approach to dynamical modeling of power systems. This approach allowed us to construct a distributed controller that can be generalized to systems of arbitrary topology with an arbitrary number of generators and FACTS devices.