

Intelligent Monitoring and Control of Electric Power Systems

The electric power system is a complex and dynamic network of generation sources, transmission and distribution lines, loads, and protective or control devices. Power systems belong in the category of critical infrastructure systems since possible faults or failures in their operation influence industrial production, disturb business and office operations and may also endanger human lives. The ever-increasing demand for electricity and the operation in deregulated, competitive energy market conditions places extreme pressure on the operation of modern-day power systems. Global climate change has led many governments around the world to impose stricter regulations and targets regarding electricity generation and supply. There is a drive for an increased share of renewables, clean sources of energy for the electricity supply, and a transformation towards a more reliable, efficient and customer oriented power grid (what is termed as the smart grid).

Major challenges are the optimization and the increased efficiency of power systems, improved security and reliability, the integration of renewable energy sources, and the transition to a wide area monitoring and control supervisory system.

Major successes:

- Developed new device placement methodologies for phasor measurement units (optimal coverage of the power system in wide area fashion)
- Patent on a system for the smooth and regulated generation of renewable electricity
- Installed and operating one of the largest hybrid renewable/hydrogen fuel cell systems in the world (40 kW rated power capacity)
- Developed a novel hybrid optimization algorithm for the solution of complex multi-objective optimization problems

KIOS researchers are working on:

- New hybrid state estimation techniques incorporating measurements of the power system states obtained through GPS synchronization
- Economic dispatch of renewable and conventional generation
- Electric load forecasting
- Smart grids
- Optimal integration of renewable energy sources to the power grid
- New monitoring and control algorithms for the optimization of power systems
- Energy efficiency and energy savings algorithms and processes



Local and international collaborations

- Electricity Authority of Cyprus (EAC)
- Cyprus Energy Regulatory Authority (CERA)
- Transmission System Operator (TSO)
- The University of Manchester
- Arizona State University
- University Politehnica of Bucharest