

Modelling and control challenges of sustainable power systems

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The future power/energy systems will be characterised by blurred boundaries between transmission and distribution system, by mix of wide range of electricity generating technologies (conventional hydro, thermal, nuclear and power electronic interfaced stochastic and intermittent renewable generation), responsive and highly flexible, typically power electronics interfaced, demand and storage with significant temporal and spatial uncertainty, proliferation of power electronics (HVDC, FACTS devices and new types of load devices) and significantly higher reliance on the use of measurement data including global (Wide Area Monitoring) signals for system identification, characterization and control and Information and Communication Technology embedded within the power system network and its components.

In order to successfully control such complex system its parts and components and to ensure its stability and security at acceptable cost, the system modelling and analysis need to cater for significantly increased uncertainties, both in terms of model uncertainties and operational uncertainties, and for efficient knowledge extraction from large amount of data coming from different types of local and wide area distributed data acquisition devices and monitors.

This presentation identifies some of the challenges associated with the modelling and analysis of such complex systems, suggests possible approaches to deal with them and gives examples of methodologies that can be used to successfully model, analyse and control them.