

Interconnected Power System Response to Generation Governing: Present Practice and Outstanding Concerns

Monday, 25 June, 2:00 PM–5:00 PM

Sponsored by: Power System Dynamic Performance Committee

Chairs: R. Schulz, Richard Schulz LLC, P. Pourbeik, EPRI

This panel session constitutes a report out of the activities and findings of the IEEE Task Force on Large Interconnected Power System Response to Generation Governing. Presentations will be given by key Task Force members on present practices on primary governing response in major interconnected power systems. A presentation will also be given on the findings, conclusions and recommendations of the Task Force. This is a unique opportunity to participate in a discussion on the key concerns and issues surrounding primary frequency control in present day interconnected power systems.

PRESENTATIONS AND PANELISTS:

- 07GM0449, Primary Governing and Frequency Control in ERCOT
R. BOYER, *TXU Electric Delivery Company*

- 07GM0479, Generator Response and Exposure During the June 25, 1998 Northern MAPP Disturbance
T. BARTEL, *Minnkota Power Cooperative, Inc.*

- 07GM0584, Relating Primary Governing Frequency Response to Future Operating Reliability
H. ILLIAN, *Energy Mark, Inc.*

- 07GM0713, Monitored Unit and System Governing Response to Large Frequency Changes Following Loss of Generation in Normal System Operation
R. SCHULZ, *Richard Schulz LLC*
J. INGLESON, *NYISO*
E. ALLEN, *NERC*

Power System Stability Controls Subcommittee – Linear Analysis Techniques

Tuesday, 26 June, 8:00 AM–12:00 PM

Sponsored by: Power System Dynamic Performance Committee

Chair: J. Sanchez-Gasca, GE Energy

This session is focused on recent practical applications of linear analysis techniques. The material covers a wide range of topics that illustrate the value of linear analysis methods for understanding power system dynamics, and for mitigating undesirable electromechanical oscillations. The presenters will discuss the analysis of oscillations and control design techniques,

from different perspectives, emphasizing practical issues. This session is part of a series sponsored by the Power System Dynamic Performance Committee with the objective of disseminating, in a timely manner, developments related to the application of linear analysis techniques.

PAPERS AND AUTHORS:

- 07GM0304, Coordinated Stabilizer Tuning in Large Power Systems Considering Multiple Operating Conditions
J. FERRAZ, *CEPEL*
N. MARTINS, *CEPEL*
G. TARANTO, *UFRJ/COPPE*

- 07GM0356, Analysis of Oscillations with Eigenanalysis and Prony Techniques
R. KOESSLER, *ABB, Inc.*
F. PRABHAKARA, *ABB, Inc.*
A. AL-MUBARAK, *Saudi Electricity Company*

- 07GM0850, Critical Eigenvalues Tracing for Power System Analysis via Continuation of Invariant Subspaces and Projected Arnoldi Method
D. YANG, *CAISO*
V. AJJARAPU, *Iowa State University*

- 07GM1371, Challenges on Small-Signal Analysis of Large Interconnected Power Systems
L. LIMA, *Siemens PTI*

- 07GM1391, A Perspective on WAMS Analysis Tools for Tracking of Oscillatory Dynamics
D. TRUDNOWSKI, *Montana Tech*
J. HAUER, *Pacific NW National Lab*
J. DESTEESE, *Pacific NW National Lab*

- 07GM1412, A New Stabilizer and Design Algorithm to Minimize the Excitation of Undesirable Oscillations
N. KSHATRIYA, *University of Manitoba*
U. ANNAKAGE, *University of Manitoba*
A. GOLE, *University of Manitoba*

Microgrids: Simulation and Control of Microgeneration

Wednesday, 27 June, 2:00 PM–5:00 PM

Sponsored by: Power System Dynamic Performance Committee

Chairs: N. Hatziargyriou, NTUA

C. Marnay, Berkeley Lab

Panel Summary:

The emergence of small semi-autonomous power systems, microgrids, consisting of groupings of generating, some of them intermittent and some with CHP, and storage assets together with loads, some of which might be controllable, creates complex control problems. This is a technical, economic, and environmental challenge because of the complexity of the problem relative to the size and economic capacity of these grids together with the immediacy of environmental problems related to generation close to population. Effective deployment of microgrids will require careful consideration of economic and environmental gain versus technical complexity, cost, and reliability. One of the main technical challenges is the control of inertia-less microgeneration in order to maintain frequency and voltage within acceptable limits, especially in isolated mode of operation.

07GM0613, Modeling and Control Design of a Micro-Turbine Generator Unit
F. GAO, *University of Toronto*
R. IRAVANI, *University of Toronto*

07GM0860, Optimal Technology Selection and Operation of Microgrid Applications in Commercial Buildings
C. MARNAY, *Berkeley Lab*
G. VENKATARAMANAN, *University of Wisconsin, Madison*
M. STADLER, *Berkeley Lab*
A. SIDDIQUI, *University College, London*
R. FIRESTONE, *Berkeley Lab*
B. CHANDRAN, *Berkeley Lab*

07GM1061, Small Signal Dynamics of Inverter Interfaced Distributed Generation in a Chain-Microgrid
G. VENKATARAMANAN, *University of Wisconsin-Madison*
M. ILLINDALA, *Caterpillar Inc.*

07GM1163, Control of Microgrids
K. DE BRABANDERE, *Katholieke Universiteit Leuven*
J. DRIESEN, *Katholieke Universiteit Leuven*
R. BELMANS, *Katholieke Universiteit Leuven*

07GM1177, Microgrid Standards and Technology Development
B. KROPOSKI, *NREL*

07GM1234, Structures of Small Power Supply Networks
H. MAEJIMA, *Mitsubishi Research Institute, Inc.*
Y. FUJIOKA, *Mitsubishi Research Institute, Inc.*
Y. KOJIMA, *Mitsubishi Electric Corp.*
S. NAKAMURA, *Mitsubishi Electric Corp.*
S. UESAKA, *New Energy and Industrial Technology Development Organization*
T. GODA, *University of Kyushu*

07GM1276, Control Issues of Inverters in the Formation of L.V. Micro-Grids

N. SOULTANIS, *National Technical University of Athens*
N. HATZIARGYRIOU, *National Technical University of Athens*

Advanced Stability Controls

Thursday, 28 June, 1:00 PM–5:00 PM

Sponsored by: Power System Dynamic Performance Committee

Chair: C. Canizares, University of Waterloo

Panel Summary:

In the last few years, with the widespread use of phase measurement units (PMUs), new widearea control (WAC) concepts and techniques are being developed and applied. These new control techniques are based on real-time measurement and monitoring of the power grid, using a variety of methodologies to determine on-line whether a system is close to its stability limits and thus take corrective and/or control actions. For example, a variety of system identification techniques have been developed and implemented to detect low-damped modes based on wide-area measurement systems (WAMS), which are then used to design PSS and/or FACTS controllers to damp system oscillations that may be triggered by these modes. In this panel session, recognized experts from industry and academia will discuss the latest research and application advancements on WAMS and WAC for power system stability enhancement.

PRESENTATIONS AND PANELISTS:

- 07GM0279, On-Line Damping Torque Estimation and Oscillatory Stability Margin Prediction
H. GHASEMI, *IESO Ontario*
C. CANIZARES, *University of Waterloo*

- 07GM0316, Robust Signals for the TCSC Oscillation Damping Controllers of the Brazilian North-South Interconnection Considering Multiple Power Flow Scenarios and External Disturbances
D. SAVELLI, *TRANSPETRO*
P. PELLANDA, *IME*
N. MARTINS, *CEPEL*
N. MACEDO, *FURNAS*
G. LUZ, *FURNAS*
A. BARBOSA, *ONS*

- 07GM0376, Implementation and Applications of Wide-Area Monitoring Systems
M. LARSSON, *ABB Switzerland Ltd.*
P. KORBA, *ABB Switzerland Ltd.*

M. ZIMA, *ATEL AG.*

- 07GM0804, New Wide-Area Algorithms for Detection and Mitigation of Angle Instability Using Synchrophasors

D. HU, *Washington State University*

V. VENKATASUBRAMANIAN, *Washington State University*

- 07GM1033, Towards Real-Time Implementation of Adaptive Damping Controllers for FACTS Devices

P. KORBA, *ABB Switzerland Ltd.*

M. LARSSON, *ABB Switzerland Ltd.*

B. CHAUDHURI, *Imperial College London*

B. PAL, *Imperial College London*

R. MAJUMDER, *University of Queensland*

R. SADIKOVIC, *ETH Zurich, Switzerland*

G. ANDERSSON, *ETH Zurich, Switzerland*

- 07GM1106, Integrating Dynamic Optimization Methodologies with WAMS Technologies

S. BRUNO, *Politecnico di Bari*

M. DE BENEDICTIS, *Politecnico di Bari*

M. LA SCALA, *Politecnico di Bari*

- 07GM1239, Wide-Area Measurement and Control for Dynamic Stability

D. WILSON, *Psymetrix Ltd.*

- 07GM1296, Regulation and Damping Control Design for Interline Power Flow Controllers

X. JIANG, *Rensselaer Polytechnic Institute*

X. FANG, *Rensselaer Polytechnic Institute*

J. CHOW, *Rensselaer Polytechnic Institute*

A. EDRIS, *Electric Power Research Institute*

E. UZUNOVIC, *New York Power Authority*