Guodong Liu

One Bethel Valley Road P.O. Box 2008, MS-6070 |Oak Ridge, TN 37831-6070| Email: liug@ornl.gov |Tel: (865)241-9732

Education

Ph.D. in Electrical Engineering, The University of Tennessee, Knoxville, USA 08/2009-01/2014

- Thesis: "Generation Scheduling for Power Systems with Demand Response and a High Penetration of Wind Energy"; Advisor: K. Tomsovic.

M.S. in Electrical Engineering, Huazhong University of Science and Technology, China 08/2007-06/2009

- Thesis: "Restoration of Distribution Network with Microgrid"; Advisor: Y. Luo

B.S. in Electrical Engineering, Shandong University, China 08/2003-06/2007

- Emphasis: Computational Methods in Power System Operation

Work Experience

Post-Doctoral Research Associate, at **The University of Tennessee, Knoxville** 02/2014- 04/2014

- Developed basic functions of Microgrid Energy Management System (MEMS), including forecasting, unit commitment and economic dispatch.
- Proposed special function of MEMS, including islanding mode, voltage/VAR support, unbalanced 3-phase AC power flow and stochastic microgrid bidding strategy in market.

Post-Doctoral Research Associate, at **Oak Ridge National Laboratory (ORNL)** 05/2014- 05/2015

- Design Microgrid EMS functions.
- Test the MEMS on the ORNL DECC system, possibly on the whole ORNL campus system.
- Developing proposals related with microgrid and distribution system operation and planning.

R&D Staff, at **Oak Ridge National Laboratory (ORNL)** 05/2015- Present

- Conduct research on various areas of electric power system.
- Developing proposals related with microgrid and distribution system operation and planning

Research Experience

Microgrid Energy Management System (MEMS) and Grid Interface Development, sponsored by **Oak Ridge National Laboratory (ORNL), DOE** 12/2012- 01/2014

- Defined economic models of components, such as wind turbine, PV, gas turbine, load, PHEV and storage.
- Developed basic functions of EMS, including forecasting, unit commitment and economic dispatch.
- Proposed special function of MEMS, including islanding mode, voltage/VAR support, unbalanced 3-phase AC power flow and stochastic microgrid bidding strategy in market.
- Program the human interface of MEMS
- Test the MEMS on the ORNL DECC system, possibly on the whole ORNL campus system

Robust Unit Commitment with Uncertain Demand Response, sponsored by **NSF ECCS-1001999** 09/2011- 08/2013

- Introduced a new robust unit commitment (UC) model aimed to minimize the generalized social cost, which consists of generation cost and opportunity cost of reduced demand or alternative cost of electricity consumption.
- Constrained by the worst case, the UC solution of the proposed model is robust against all possible realizations of the modeled uncertain demand response.
- Reduced or eliminated the occurrence of price spikes under various distributions and high forecast errors of demand price elasticity.

Security Constrained Unit Commitment with Demand Response, sponsored by **NSF ECCS-1001999** 09/2011- 10/2012

- Designed a new bidding mechanism for demand response providers in co-optimized energy and reserve market.
- Formulated a two-stage stochastic security constrained unit commitment problem to clear the market and schedule the energy and spinning reserve.
- Tested the proposed bidding mechanism and compared it with conventional price responsive demand shifting bids

in operating efficiency.

Quantify Spinning Reserve in Systems with Significant Wind Power Penetration, sponsored by **NSF EEC-1041877** and the **Global Climate and Energy Project (GCEP)** at Stanford University 08/2009-03/2012

- Established probability model of wind speed and wind power.
- Reviewed methods of integrating wind speed forecast error into day-ahead market clearing.
- Proposed probability methods of quantify spinning reserve for uniform system reliability considering wind power.
- Constructed new model of security constrained unit commitment (SCUC) and security constrained economic dispatch (SCED) capable of integrating forecast results of wind speed, load and reliability model of units.
- Demonstrated the proposed models on IEEE Reliability Test System.

Restoration of Distribution Network with Microgrid, sponsored by **National Natural Science Foundation of China (NSFC)** 09/2008-07/2009

- Surveyed the methods of automatic reconfiguration of distribution system with distributed generation resources.
- Developed restoration strategy of distribution network with microgrid.

Cascading Failure Analysis of Jiangxi Power Grid Based on Fault Chains Theory, sponsored by **Jiangxi Electrical Power Research Institute** 07/2008~04/2009

- Built the research model of Jiangxi power grid and operation modes
- Analyzed possible multi-failures on the main power supply routes
- Proposed measures to prevent large area power blackout

Research Interests

- Power system planning, operation and electricity market simulation
- Power systems reliability and security assessment
- Distributed energy resources and demand response management
- Large-scale integration of renewable energy resources
- Optimization methods and its application in power systems

Journal Publications

- B. Moradzadeh, **G. Liu** and K. Tomsovic, "Reconfiguration of a Distribution System with Load Uncertainty," submitted to *IEEE Transactions on Smart Grid*.
- **G. Liu**, M. Starke, and K. Tomsovic "Microgrid Optimal Scheduling With Chance-Constrained Islanding Capability," submitted to IEEE Transactions on Smart Grid.
- **G. Liu**, Y. Xu and K. Tomsovic, "Bidding Strategy for Microgrid in Day-ahead Market based on Hybrid Stochastic/Robust Optimization," *IEEE Transactions on Smart Grid,* Vol. 7, No. 1, Jan. 2016, pp. 227 - 237.
- **G. Liu** and K. Tomsovic, "Robust Unit Commitment Considering Uncertain Demand Response," *Electric Power Systems Research*, Vol. 119, Feb. 2015, pp. 126-137.
- **G. Liu** and K. Tomsovic, "A Full Demand Response Model in Co-Optimized Energy and Reserve Market," *Electric Power Systems Research*, Vol. 111, Jun. 2014, pp. 62–70.
- **G. Liu** and K. Tomsovic, "Quantifying Spinning Reserve in Systems with Significant Wind Power Penetration," *IEEE Transactions on Power Systems*, Vol. 27, No. 4, Nov. 2012, pp. 2385 - 2393.

Conference Publications

- **G. Liu**, M. Starke, X. Zhang and K. Tomsovic "A MILP-Based Distribution Optimal Power Flow Model for Microgrid Operation," Proceedings of the 2016 IEEE PES General Meeting, Boston, MA, Jul. 17-21, 2016.
- **G. Liu**, B. Xiao, M. Starke, O. Ceylan and K. Tomsovic, "A Robust Load Shedding Strategy for Microgrid Islanding Transition," *Proceedings of the 2016 IEEE PES T&D Conference& Exposition*, Dallas, TX, May. 2-5, 2016.
- **G. Liu**, O. Ceylan, M. Starke and K. Tomsovic, "Advanced Energy Storage Management in Distribution Network," *Proceedings of the 49th Hawaii International Conference on System Sciences (HICSS-49)*, Kauai, HI,

Jan. 5-8, 2016.

- B. Xiao, K. Prabakar, M. Starke, **G. Liu**, K. Dowling, B. Ollis, P. Irminger, Y. Xu and A. Dimitrovski, "Development of Hardware-in-the-loop Microgrid Testbed," *Proceedings of IEEE Energy Conversion Congress and Exposition (ECCE 2015)*, Montreal, Canada, Sept. 20-24, 2015.
- O. Ceylan, **G. Liu**, and K. Tomsovic, "Parallel Harmony Search Based Distributed Energy Resource Optimization," *Proceedings of Intelligent System Applications to Power Systems (ISAP 2015)*, Porto, Portugal, Sept. 11-16, 2015.
- **G. Liu**, O. Ceylan, Y. Xu and K. Tomsovic "Optimal Voltage Regulation for Unbalanced Distribution Networks Considering Distributed Energy," *Proceedings of the 2015 IEEE PES General Meeting*, Denver, CO, Jul. 26-30, 2015.
- O. Ceylan, **G. Liu**, Y. Xu and K. Tomsovic "Distribution System Voltage Regulation by Distributed Energy Resources," *Proceedings of the 2014 North American Power Symposium (NAPS)*, Pullman, WA, Sept. 7-9, 2014.
- **G. Liu**, Y. Xu, O. Ceylan and K. Tomsovic "A New Linearization Method of Unbalanced Electrical Distribution Networks," *Proceedings of the 2014 North American Power Symposium (NAPS)*, Pullman, WA, Sept. 7-9, 2014.
- **G. Liu** and K. Tomsovic, "Quantify Spinning Reserve for Uniform System Reliability Considering Wind Power," Proceedings *of the 12th International Conference on Probabilistic Methods Applied to Power Systems (PMAPS 2012)*, Istanbul, Turkey, June 10-14, 2012.

Honors

- 2009~2011 Department Excellence Fellowship, the University of Tennessee, Department of EECS
- 2008 NARI-Relays scholarship, HUST
- 2008 Excellent Students in Academia of HUST, HUST
- 2007~2009 Full Scholarship of HUST for two consecutive years, HUST
- 2004~2006 Excellent Students **(5%)** for two consecutive years, Shandong University
- 2004~2006 First-class Scholarship **(5%)** for two consecutive years, Shandong University

References

- **Dr. Kevin Tomsovic**: CTI professor, Dept. of EECS, the University of Tennessee, Knoxville, Email: tomsovic@tennessee.edu, Tel: 865-974-2693.
- **Dr. Yilu Liu**: Governor's Chair, Dept. of EECS, the University of Tennessee, Knoxville, Email: liu@utk.edu, Tel: 865-974-4129.
- **Dr. Fangxing Li:** Associate Professor, Dept. of EECS, the University of Tennessee, Knoxville, Email: fli6@utk.edu, Tel: 865-974-8410.