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Challenges in Modeling, Optimization and Control of Coupled Natural Gas and Power Networks



Michael Chertkov

Los Alamos National Lab

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ABSTRACT: Challenges in simulation, optimization and control of natural gas transmission systems and their coupling to power transmission systems are reviewed in this presentation describing research on the subject by the Grid Science Team at LANL. In this presentation I will describe opportunities but also challenges emerging in view of new dependencies between power and natural gas regional, national, and international systems. The availability of natural gas and the need for cleaner electric power have prompted widespread installation of gas-fired power plants and caused electric power systems to depend heavily on reliable gas supplies. The use of gas generators for base load and reserve generation causes high intra-day variability in withdrawals from high pressure gas transmission systems, which leads to gas price fluctuations and supply disruptions that affect electric generator dispatch and threaten the security of power and gas systems. The new situation sets up new problems for optimization dispatch schedule and gas compressor protocols which need to be compared with the status quo solutions. Some early work on this emerging subject will be discussed. In this talk I will also attempt to give a broader overview of variety of questions, methods and solutions from physics (of electric and gas flows), statistics, applied mathematics, optimization, control, machine learning and other theoretical engineering disciplines which are expected to play significant role in this exciting area of applied research.

BIO: Dr. Chertkov's areas of interest include statistical and mathematical physics applied to energy and communication networks, machine learning, control theory, information theory, computer science, fluid mechanics and optics. Dr. Chertkov received his Ph.D. in physics from the Weizmann Institute of Science in 1996, and his M.Sc. in physics from Novosibirsk State University in 1990. After his Ph.D., Dr. Chertkov spent three years at Princeton University as a R.H. Dicke Fellow in the Department of Physics. He joined Los Alamos National Lab in 1999, initially as a J.R. Oppenheimer Fellow in the Theoretical Division. He is now a technical staff member in the same division. Dr. Chertkov has published more than 150 papers in these research areas. He is an editor of the Journal of Statistical Mechanics (JSTAT), associate editor of IEEE Transactions on Control of Network Systems, member of the Editorial Board of Scientific Reports (Nature Group), a fellow of the American Physical Society (APS) and a senior member of IEEE.