

Distinguished Lectures

Spring 2023



Dr. Anna Scaglione

Professor, Electrical & Computer Engineering

Cornell Tech

The New York City campus of Cornell University

The Coupling of Electric Power and Transportation Infrastructures: Opportunities and Challenges

Monday, April 10, 2023

Reception with refreshments: 10:30 a.m.

Lecture: 11:00 a.m.-12:00 noon

Lory Student Center 312

Grid Graph Signal Processing: Theoretical Models and Machine Learning Algorithms

Monday, April 10, 2023

Lecture: 3:00-4:00 p.m.

Lory Student Center 300

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Colorado State University's Information Science
and Technology Center (ISTeC)

In conjunction with the Department of Computer Science and
Department of Electrical and Computer Engineering Seminar Series

Abstracts

The Coupling of Electric Power and Transportation Infrastructures: Opportunities and Challenges

The electric grid is at the cusp of significant transformation, due to the pressure of increasing the penetration of distributed renewable energy resources that is both economically beneficial (renewable energy has never been cheaper) as well as necessary to curb CO2 emissions and address climate change. On the demand side, the greatest pressure for change comes from ensuring a smooth transition to electrified transportation systems. In fact, large populations of electric vehicles can be either an immense resource of flexibility for the grid, or a foe, depending on how car charging is managed both spatially as well as in time. This talk will explain why, if car charging that is not aligned with peaks of renewables, the costs of power generation and delivery will increase while global CO2 emissions may be minimally affected. More importantly, we will describe possible solutions. Specifically, we will model the coupling for these two networks that allows to define strategies for computing congestion pricing for travel and charging at the retail level. We will discuss how to design digital interfaces, so that individuals can make independent driving and charging decisions, while minimizing energy and transportation costs. Furthermore, we will describe how to capture this flexibility at the level of whole-sale markets of electricity, through aggregate low order models that allow to foresee the behavior of the populations of electric vehicles in clearing the market at the transmission grid level.

Grid Graph Signal Processing: Theoretical Models and Machine Learning Algorithms

This presentation proposes that physical laws governing signals from infrastructures, such as the grid, can be viewed as examples of a Graph Signal Processing (GSP) signal. By doing so, statistical and algebraic properties of the signal can be uncovered, and GSP can be applied to develop machine learning algorithms using a parametric Bayesian framework. The talk introduces the algorithmic foundations of GSP modeling for analyzing signals and multivariate-time series on a graph and shows how power systems modeling supports the idea that grid voltage phasors are a low-pass graph signal process. The connection between GSP modeling and Graph Fourier Transforms (GFTs) is established, and the talk explores how to use them to derive various applications, including sampling schemes, denoising, interpolation, classification, system identification, and showcases how graph neural networks can be applied to inference problems and reinforcement learning.

Speaker Biography

Anna Scaglione (M.Sc.'95, Ph.D. '99) is currently a professor in Electrical and Computer Engineering at Cornell Tech, the New York City campus of Cornell University. Prior to rejoining Cornell in 2022, she held faculty positions at Arizona State University, the University of California at Davis, Cornell University (the first time, from 2001 to 2008) and the University of New Mexico. She is IEEE Fellow since 2011 and received the 2013, IEEE Donald G. Fink Prize Paper Award, the 2000 IEEE Signal Processing Transactions Best Paper Award the NSF CAREER grant (2002). She is co-recipient with her students of several best student papers awards at conferences and received the 2013 IEEE Signal Processing Society Young Author Best Paper Award with one of the PhD students. She was Distinguished Lecturer of the Signal Processing Society in 2019 and 2020. Dr. Scaglione's expertise and research considers theoretical and applied problems in statistical signal processing, communications networks and cyber-physical infrastructures for sustainable energy delivery systems, where her work has focused on addressing renewable sources and demand response integration and emerging cyber-security challenges in embedding intelligence in critical infrastructures systems.

To arrange a meeting with the speaker, please contact Prof. Anura Jayasumana {Anura.Jayasumana@ColoState.edu}.