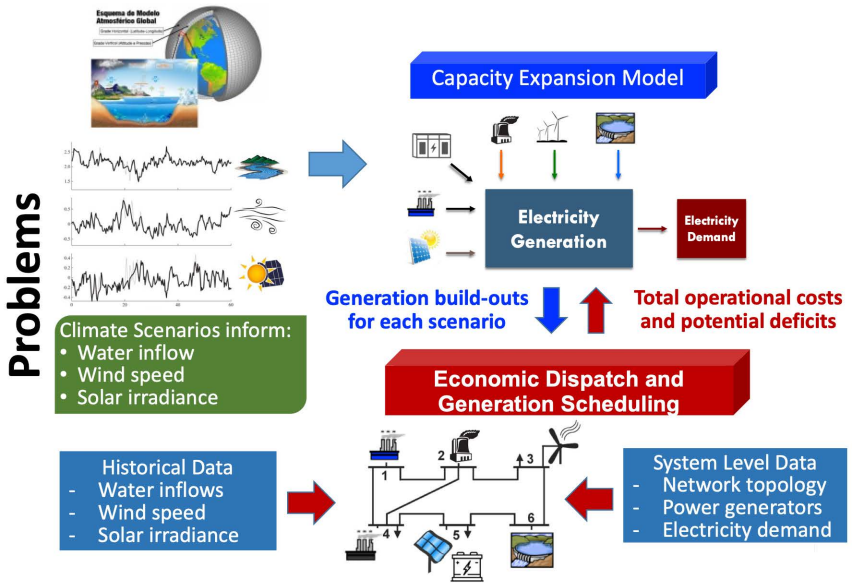
Applied Optimization to Energy & Power Systems

CE 591 / OR 591 / ECE 591(sec23)

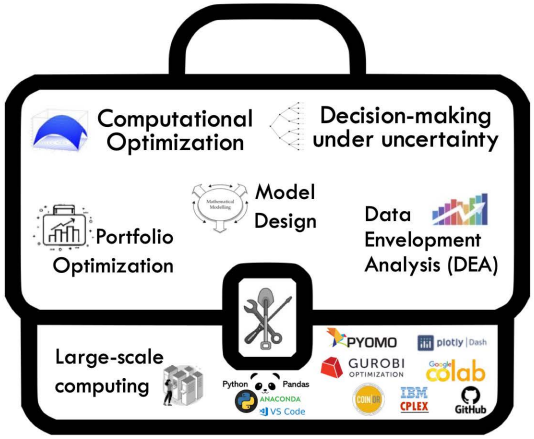
Fall 2024, T-Th 10:15am – 11:30am

Context

The **integration of renewables and energy storage** in existing grids bring **complexities to management and investment perspectives** that many times are approached through **optimization techniques**



Methods & Tools



Professor:
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We will give special attention to practical applications such as renewable energy scheduling, economic dispatch, resource & energy storage management, portfolio optimization, and long-term planning, preparing students for challenges in the modern energy and power systems industry

Join us for a semester of interdisciplinary learning and sharing!

Computing & Systems Group

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Applied Optimization for Energy and Power Systems
CE591 / OR 591 / ECE 591 (sec 23)

Prerequisites: CE 339 or a graduate level course in optimization (e.g. OR 501); background in Python or equivalent

Instructor:

Dr. Anderson Rodrigo de Queiroz
Associate Professor of Civil Engineering and Operations Research Graduate Program
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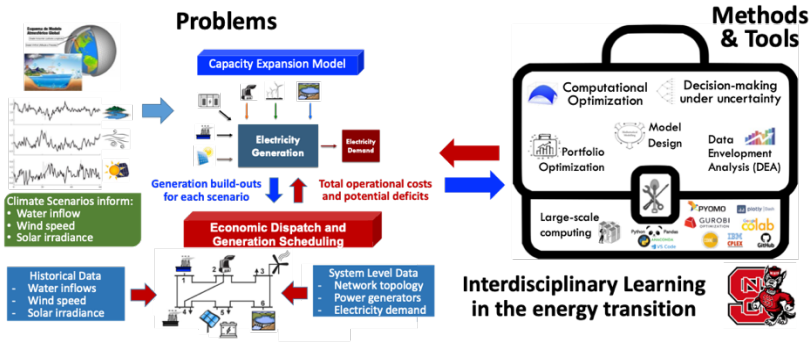
This class is designed to teach mathematical optimization focusing on planning, coordination, and scheduling perspectives for managing energy and power systems problems. The mathematical perspective applies a systems analysis approach and computational modeling to identify management strategies and inform decision-making. The class format will include both lectures and student discussion. Students will complete assigned readings, homework assignments, and a course final project.

Course Synopsis: This graduate level course on *"Applied Optimization for Energy and Power Systems"* is designed to bridge concepts between theoretical optimization techniques and their practical applications in energy and power systems. This is a multi-disciplinary course in intersection between Civil Engineering Systems, Operations Research, and Electrical Power Systems. The goal is to provide a broad view about complex problems and challenges in today's energy sector and how one can attempt to solve them.



Justification: This course aims to address the growing reliance of the energy sector in our society and the recurrent problems that analysts and decision-makers face when planning, designing, and operating these systems. The integration of renewables and energy storage technologies in existing grids bring complexities from the management and investment perspectives that many times are approached through advanced optimization techniques. Such complexities arise in energy generation, transmission, and consumption. We will give special attention to practical applications such as renewable energy scheduling, generation economic dispatch, resource and energy storage management, portfolio optimization, and long-term planning, preparing students for challenges in the modern energy and power systems industry. We present optimization algorithms, including decomposition-based methods, risk-averse optimization, and other tools, essential for informing decision-making in these systems.

Course Content: The curriculum includes a mix of optimization theory (e.g., large-scale linear programs, mixed-integer linear programming, stochastic programming, multi-period optimization) with applications in energy and power systems (e.g., long-term planning, economic dispatch, resource scheduling), renewable energy technologies investments (e.g., solar, wind, hydropower), energy storage (short-term and long-term duration storage), and other case studies based on current challenges in the sector.

Target Audience: This course is designed for graduate students in Civil Engineering, Operations Research, and Electrical Engineering (with focus in Power Systems) who are interested in renewable energy systems, sustainable development, energy transition, and applied optimization. It is also beneficial for professionals in the industry seeking advanced knowledge in optimization and practical applications.