**ABSTRACT:**
We design an agent-based framework for real-time and explicit control of electrical grids with a heterogeneous mix of intermittent and uncertain generation (like PV), storage capacity and loads. The method is scalable to grids of any size, and solves the problems of quality of service and energy balance without major investment. Our approach avoids solving stochastic mixed-integer optimization at each time step. Instead, the control method is based on projected gradient descent. The framework provides a "Grid Operating System" that allows device controllers for intelligent buildings, e-car charging systems, etc. to be easily connected and provide real time support to the grid.

**Design of Commelec Resource Agents with Guaranteed Tracking Properties**
In a basic setup of Commelec, one centralized 'grid agent' (GA) controls a number of resources, where each resource is either a load, a generator, or a combination thereof, like a battery. The GA periodically computes new power setpoints for the resources based on the estimated state of the grid and an overall objective, and subject to safety constraints. Each resource is augmented with a resource agent (RA), which takes care of communicating with the grid agent and implements the power-setpoint requests sent by the GA on the resource.

In this talk, we focus on the resource agents (including the resources that they manage) and their impact on the overall system's behavior. Intuitively, for the system to converge to the overall objective, the RAs should be obedient to the requests from the GA, in the sense that the actually implemented setpoint should be close to the requested setpoint, at least on average.

We propose a formal notion of obedience called $c$-bounded accumulated-error for some constant $c \geq 0$. We then demonstrate the usefulness of our notion, by presenting theoretical results (for a simplified scenario) as well as some simulation results (for a more realistic setting) that indicate that, if all resource agents in the system have $c$-bounded accumulated-error, the closed-loop system converges on average to the objective.

Also, we show resource agents that (provably) have $c$-bounded accumulated-error for resources with uncertainty (e.g., PV panels) and for resources with a discrete set of implementable setpoints (e.g., heating systems with heaters that each can either be switched on or off).

**Dr. Bernstein’s and Dr. Bouman’s bios are available via http://bit.ly/1SizChc**