

Application of decomposition/coordination methods to the optimal control of a microgrid.

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Most of european countries are committed to produce more than 20 % of their electrical energy with renewable energies by 2020, and smart and micro-grids are more and more put forward to achieve this goal. These new technologies allow utility managers to control in real time the consumption of consumers and the production of different power plants.

Deterministic control methods, such as Model Predictive Control (MPC), are widely used to manage a micro-grid. But consumptions and renewable energy productions are hardly foreseeable, and make it difficult to satisfy the adequation between demand and production in deterministic framework. This is why we focus on stochastic optimal management to control a micro-grid.

We consider here a domestic micro-grid, that is a house equipped with smart devices (thermostat, controller) and whose energy is produced by renewable sources (micro-cogeneration, solar panels). We will use stochastic optimal control to manage energy flows in the system, and test control laws on a realistic numerical model. We will put emphasis on the algorithms used (dynamic programming, SDDP) and the numerical results obtained. A benchmark with other methods, such as MPC, will be presented.

This work is part of a larger program, aiming to control a grid where several houses and decentralized power sources are connected together through the local network. As the size of the problem increases, other methods must be investigated to tackle the curse of dimensionality. Decomposition and coordination schemes have proved their effectiveness in deterministic settings, and DADP (Dual Approximate Dynamic Programming) offers promising results in the stochastic framework. In the last part of this talk, we will sketch some perspectives to apply such algorithms to large-scale smart-grid problems.

Références

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