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Title: A new mixed integer optimal control formulation of UC Problem

Oral presentation: UC problem formulation

Abstract:

The Unit Commitment (UC) problem is a well–known combinatorial optimization problem in power systems. This work addresses a mixed integer optimal control formulation of the UC problem, with both binary–valued control variables and real–valued control variables. In the UC problem, the goal is to schedule a subset of a given group of electrical power generating units and also to determine their production output in order to meet energy demands at minimum cost. In addition, the solution must satisfy a set of technological and operational constraints.

This problem is usually formulated as a nonlinear mixed–integer programming problem and it has been solved in the literature by a large variety of optimization methods ranging from exact methods (such as dynamic programming, branch-and-bound) to heuristic methods (genetic algorithms, tabu search, simulated annealing, particle swarm). For medium sized power systems, exact methods can be used to solve the UC problem, successfully. However, for larger systems, the computation time of exact methods becomes impractical since the size of the solution space increases exponentially with the number of time periods and units in the system. In these cases, heuristic methods can be used to find near–optimal solutions.

In this work, we present a new formulation of the UC problem as a mixed–integer optimal control problem, with both binary–valued control variables and real–valued control variables. Then, we use a variable time transformation method to convert the problem into an optimal control problem with only real–valued controls. The optimal control problem is transcribed into a finite–dimensional nonlinear programming problem and it is solved using standard NLP solvers.