ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ

ΔΙΑΤΜΗΜΑΤΙΚΟ ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝ ΣΠΟΥΔΩΝ

"Υπολογιστική Μηχανική"

ΣΕΜΙΝΑΡΙΟ

An Energy Management System for Residential Demand Response Based on Multi-objective Evolutionary Optimization

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Abstract: Dynamic tariffs, i.e. energy prices with frequent variations possibly with significant amplitude, are expected to become an important pricing scheme in smart grids. In this setting, active residential load management can play an important role to help end-users optimizing the usage of energy resources (grid, local generation, storage and loads) to minimize the overall energy cost without compromising comfort. The scheduling of load control actions should take into account energy costs, end-users' preferences and requirements, potential dissatisfaction when the operation cycle of loads is changed, technical constraints, weather forecasts, the existence of local generation and storage systems. A multi-objective optimization approach has been developed to assist decisions weighing the minimization of the energy cost and the minimization of end-user's dissatisfaction associated with the implementation of management strategies. Due to the combinatorial nature of this model, an evolutionary algorithm has been designed to optimize the integrated usage of multiple residential energy resources considering a vast set of potential management strategies taking into account the end-user's profile regarding the acceptable balance between the cost and comfort dimensions. Those energy resources include the grid, local generation, shiftable loads, thermostatically controlled loads and storage systems (stationary and electric vehicle). The evolutionary algorithm makes the most of the physical characteristics of the problem to obtain results that can be implemented in practice with a mild computational effort. Results of case studies have shown that savings can be achieved with an energy management system based on this approach, although dependent on the end-user's preferences and willingness to accept automated control.

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