This dissertation studies multi-level optimization problem on energy system, transportation system and information network. It mainly has four projects, three of them use the concept of boundedly rational user equilibrium (BRUE) to predict the behavior of users in different systems. Another project uses two-level game theory model to simulate the prosumers’ behavior. By using multi-level optimization method with BRUE or game theory, the system can operate in a more efficient way. All of these four projects have an outer level optimization model. The variables in outer level include the pricing strategy or decision strategy. Based on the introducing of BRUE constraints and two-level game theory to the model, the system will have an uncertainty for the users’ behavior. The robust optimization is generated as the multi-level optimization model to consider for the pessimistic condition to our target users with uncertainty of all users’ behavior. In general, the models’ first level’s decision variables are the measures that the target user can control, but the second level’s decision variables are all other users’ behaviors that can only be restricted within a convex feasible region combine with BRUE constraints.

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The public is welcome to attend.