A novel approximate dynamic programming approach for constrained equipment replacement problems: A case study

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ABSTRACT

This paper presents a novel Approximate Dynamic Programming (ADP) approach to solve large-scale nonlinear constrained Equipment Replacement (ER) problems. Since ADP requires accurate estimations of states for future periods, a heuristic estimator based on data clustering was developed for the case study of this paper with small number of sampling periods. This ADP approach uses a Rollout Algorithm to formulate the problem in a Rolling horizon. The model was solved using Genetic Algorithm (GA). This framework was successfully applied for the decision making process of replacement/maintenance of 497 transformers in a power distribution company, which led to a significant reduction in the expected costs. The proposed framework possesses favourable features such as minimizing the effect of uncertainties in the state variables and measurement inaccuracies, which make the model robust and reliable. This work provides a novel general approach that can be employed for other industrial cases and operations research problems.

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