

## **A Simulation-Optimization Approach to Control Production, Subcontracting and Maintenance Decisions for a Deteriorating Production System**

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**Abstract :** This research studies the joint production, maintenance and subcontracting control policy for an unreliable deteriorating manufacturing system. Production activities are controlled by a derivation of the Hedging Point Policy, and given that the system is subject to deterioration, it reduces progressively its capacity to satisfy product demand. Multiple deterioration effects are considered, reflected mainly in the quality of the parts produced and the reliability of the machine. Subcontracting is available as support to satisfy product demand; also overhaul maintenance can be conducted to reduce the effects of deterioration. The main objective of the research is to determine simultaneously the production, maintenance and subcontracting rate which minimize the total incurred cost. A stochastic dynamic programming model is developed and solved through a simulation-based approach composed of statistical analysis and optimization with the response surface methodology. The obtained results highlight the strong interactions between production, deterioration and quality which justify the development of an integrated model. A numerical example and a sensitivity analysis are presented to validate our results.

**Keywords :** subcontracting, optimal control, deterioration, simulation, production planning

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