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Systems Design and reconditioning their Maintenance Plan using Multi-objective Optimisation based on Evolutionary Algorithms

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ABSTRACT

System Availability can be defined as the fraction of the total time in which systems are able to perform their required function [1]. The more available the system, the more the benefit achieved. In order to improve the availability of systems, several techniques have been explored. Two techniques widely considered are, on the one hand, the inclusion of redundant devices, and on the other hand, the consideration of preventive maintenance activities. Traditionally, these techniques have been separately analysed. The simultaneous consideration of such techniques has not received much attention yet. The authors of the present abstract conducted various studies for systems under such an approach where Unavailability and Operational Cost were considered as objective functions under a multi-objective environment [2,3]. Multi-objective Evolutionary Algorithms and Discrete Event Simulation were coupled to the simultaneous optimisation for the structural design of systems with automatic selection of devices and their maintenance strategy (both corrective and preventive).

In the present study, the authors extend the cost model previously used in such studies by considering a third objective, the Acquisition Cost. A performance comparative between an Evolutionary Algorithm based on Pareto dominance selection criterion (the Non-dominated Sorting Genetic Algorithm II, NSGA-II) and an Evolutionary Algorithm based on the Hypervolume indicator selection criterion (the S-Metric Selection Evolutionary Multiobjective Optimisation Algorithm, SMS-EMOA) is conducted. Furthermore, several configurations of the Evolutionary Algorithms are tested in order to identify the most efficient parameters configuration. Hypervolume indicator and statistical tests are used to compare the performance of the different configurations of the methods. Results of applying such methods to an industrial case study are provided.

REFERENCES

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