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Integrating production, inventory and maintenance planning for a parallel system with dependent components

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Abstract

This paper deals with the problem of integrating preventive maintenance and tactical production planning, for a production system composed of a set of parallel components, in the presence of economic dependence and common cause failures. Economic dependence means that performing maintenance on several components jointly costs less money and time than on each component separately. Common cause failures correspond to events that lead to simultaneous failure of multiple components due to a common cause. We use the β-factor model to represent common cause failures. This means that we assume two possible causes for system failure: the independent failure of single components, and the simultaneous common cause failure of all components. The suggested preventive maintenance is a T-age group maintenance policy in which components are cyclically renewed all together. Furthermore, between the periodic group replacements, minimal repairs are performed on failed components. We are given a set of products that must be produced by this parallel system in lots during a specified finite planning horizon. The objective is to determine an integrated lot-sizing and preventive maintenance strategy of the system that will minimize the sum of preventive and corrective maintenance costs, setup costs, holding costs, backorder costs and production costs, while satisfying the demand for all products over the entire horizon. Numerical examples are used to illustrate the proposed approach.

Keywords

Common cause; Economic dependence; Parallel systems; Minimal repair; Preventive maintenance; Production planning; Integration

Figures and tables from this article:

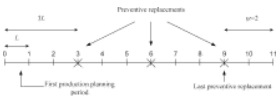

Fig. 1. Illustrative example.

Figure options

Table 1. Example of a system with two parallel components.

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Table 2. Individual characteristics of the components.

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Table 3. Characteristics of the components in case of grouped maintenance.

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Table 4. Demands of products.

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Table 5. Cost data of products.

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Table 6. Evaluation of costs for each PM alternative.

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Table 7. Optimal production plan when integrating production and PM.

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Table 8. Individual characteristics of the components (Example 2).

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Table 9. Characteristics of the components in case of grouped maintenance (Example 2).

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Table 10. Separate and integrated optimization solutions.

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Table 11. Optimal production plan when integrating production and PM (Example 2).

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