Simulation as a Decision Support Tool in Maintenance Float Systems

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KEYWORDS

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ABSTRACT

This paper is concerned with the use of simulation as a decision support tool in maintenance systems, specifically in Maintenance Float Systems. A Maintenance Float System is typically composed of a workstation, a maintenance center and a set of reserve equipments. The workstation consists of a set of identical equipments and a repair center where there is a limited number of maintenance crews to perform repairs of failed equipment. In this maintenance system, it is considered that the maintenance crews perform repair actions but also periodic overhauls to equipments where repair and overhaul times might be different. The representative model of that maintenance system is being developed using Arena ® simulation language, so as to find the optimal combination of the number of reserve units (R), the number of maintenance crews in the maintenance center (L) and the time interval between overhauls (T), based on the global cost of the maintenance system. Furthermore, the model will also be able to identify other performance measures, such as the average number of missing equipments at the workstation, the probability of waiting in the queue, the average length of the repair center, etc, and will discuss

INTRODUCTION

Increasing competitiveness requires that companies do feel the need to improve their efficiency levels. In this sense, maintenance in a company has been taking an important role, since production stops, breakdowns and also the actual performance of equipments has a direct impact on the profitability of production processes and consequently in its operating results. As such, control and optimization of maintenance of equipments are important not only for the reasons mentioned above, but also for reasons of safety of persons or of potential negative impacts on the environment. In general, conducting preventive maintenance increases the control over the equipments and avoid unexpected stops, however, if the actions are overestimated, maintenance costs will be too high and the resulting availability low. In production systems involving identical equipments as is the case for Float Systems, it becomes more beneficial to integrate the management of maintenance resources, both human and material. One evidence of that is the use of reserve equipments to replace those that fail or need overhaul. Therefore, direct and indirect costs generated by equipment stops are minimized, thus ensuring the production rate planned. Anyway we are dealing with those situations where a failure of equipment would immediately represent equipment unavailability and, therefore, the need of reserve equipments is essential – this is the case where repairing times would be extremely high. These scenarios may occur for example in companies of transport of goods or passengers, in hospitals or in companies that produce electricity.

AIMS

This doctoral draft aims to develop a support system for decision making on "Maintenance Floats Systems", using simulation as a tool. In the mentioned systems, the identical equipments operating in parallel to perform certain tasks will focus on periods when the systems failures rate is assumed as constant for the following reasons:

- When the rate is increasing, the models for calculation of reserve equipments have little interest. In these cases, the optimal values of the indicators are important variables - the optimal number of standby units, the optimal number of maintenance crews and the optimal interval between reviews, so that the action should be to act on the causes of increased rate and not about the consequences.

- When the rate is decreasing, and until the system reaches a steady state, it would be premature to plan maintenance - this occurs mainly in the periods of early life of equipments.

The general mathematical models that can be found in literature, in the area of optimizing the performance of "Float Systems", [4] [7], do not consider the simultaneous use of the number of reserve equipments the interval between revisions and the number of maintenance crews. Only very recently, [9] [12], arise in the literature developments on the simultaneous handling these indicators in "Float Systems". In these models, there is still the need to verify the behavior of the systems in relation to the various measures of performance in particular, its availability. The complexity of this analysis, in the literature, usually is exceeded by presupposed the existence of only one equipment at work or the existence of only a maintenance crew or even a maintenance capacity unlimited.
In addition to its strategic definition the company own planning of tasks assumes a key factor of success. In this direction, indicators such as the equipments availability or the average number of active equipments are crucial to effective management of the tasks to play by the respective equipments.
It must also take into account a whole range of factors that may influence the availability and performance of equipments in "Float Systems", such as: possibility of damage to the reserve equipments; the efficiency and speed of repairs, etc ([9] [12]).
Whenever preventive maintenance is the adequate policy time replacement is carried out individually and not in group, since the latter is held simultaneously for all equipments and force to stop the whole system, that in addition imply that a given moment the number of maintenance crews has to be greater.
For the particular situation under review, the intention is to built a simulation model using the Arena ® simulation language [1] a [3] that represents the behavior of the “Maintenance Float System ". Moreover it is intended to find the optimal combination number of standby units (R) , the number of maintenance crews in the maintenance center (L) and the time interval between overhauls (T), based on the maintenance costs of the system. The results will be validated by comparison with the theoretical model assumed [9], [12] and also considering new indicators to evaluate in a more simple and efficient availability and performance of equipment in the "Float Systems."

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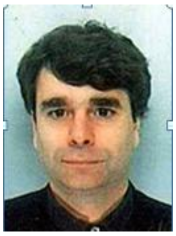

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