

## Robust design of maintenance scheduling considering engineering insurance using genetic algorithm

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Abstract— Preventive maintenance is a broad term that encompasses a set of activities aimed at improving the overall reliability and availability of a system. Designers of preventive maintenance schedules attempt to minimize the overall cost of system operation. There is no substitue for perfection in maintenance to ensure zero breakdown in machine, therefore it is necessary to get a machinery breakdown insurance against the risks that might occur at business. previous researches don't consider the effect of engineering insurance on maintenance scheduling while it affect the cost function of maintenance scheduling seriously. Engineering insurance pays for all repair costs of machinery, therefore the cost function of maintenance scheduling is affected. This paper presents a new cost function for maintenance scheduling, as well as uncertainty in the cost parameters related to cost function is very common in application, so we use scenario-based approach for robust design of maintenance scheduling. Then, genetic algorithm for obtaining optimal solution of the proposed robust model is developed and effectiveness of this model is illustrated through a numerical example.

Keywords- predictive maintenance, scheduling maintenance, machinery breakdown insurance, robust design, genetic algorithm

## I. INTRODUCTION

Maintenance Planning and Scheduling are key elements that influence the true success of any organization. Many times we have a planner or planner/scheduler, but do not know how to use him or her effectively or efficiently. When we talk about maintenance planning, we are talking about higher wrench time. At this time of economic uncertainty, a higher wrench time equals lower cost, which results in job security for all. The application of preventive maintenance scheduling has been widely used in manufacturing and production systems Past studies have shown that most companies do not perform maintenance planning effectively thus impacting negatively work effectiveness, wrench time, equipment

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uptime, equipment reliability, and cost. If we were "Effective in Maintenance Planning", it would result in Higher Wrench Time and Higher Equipment Reliability. Preventive maintenance is defined as a set of activities aimed at improving the overall reliability and availability of a system. All types of systems, from conveyors to cars to overhead cranes, have prescribed maintenance schedules set forth by the manufacturer that aim to reduce the risk of system failure Preventive maintenance activities generally consist of inspection, cleaning, lubrication, adjustment, alignment, and/or replacement of subcomponents that wear-out. In general, preventive maintenance activities can be categorized in one of two ways, component maintenance or component replacement. It is clear that preventive maintenance involves a basic trade-off between the costs of conducting maintenance and replacement activities and the cost savings achieved by reducing the overall rate of occurrence of system failures. Designers of preventive maintenance schedules must prioritize these individual costs to minimize the overall cost of system operation. They may also be interested in maximizing the system reliability, subject to some sort of budget constraint. Many researches have been done to optimize maintenance scheduling economically. Reference [1] determines optimal cost of maintenance policies by defining the average cost rate of system operation, in this study assumed that an increasing failure rate is based on the Weibull distribution function. Reference [2] develop an model to minimize the total relating to preventive maintenance schedules. Exact algorithms reach exact optimal solutions of mathematical models, while approximation algorithms seek an approximation that is close to the true optimal solutions Reference [3] present a model that optimizes the preventive maintenance scheduling in semiconductor manufacturing operations. They optimize this model via a mixed-integer linear programming model. Reference [4] present a preventive maintenance optimization model in order to minimize the total maintenance costs in a