Chapter 1

OVERVIEW OF MAINTENANCE MODELING AREAS

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Abstract This chapter provides a brief overview of the research areas of maintenance modeling. It is not meant to be a complete review of maintenance models but rather as an informative introduction to important maintenance modeling areas. Areas covered include maintenance planning and scheduling, spare parts provisioning, preventive and condition based maintenance, and integrated maintenance, production, and quality models. Directions for future research are outlined.

Keywords: Preventive maintenance, imperfect preventive maintenance, condition based maintenance, inspection, replacement, maintenance planning and scheduling, spare parts provisioning, integrated maintenance models, delay time model.

1. INTRODUCTION

Production and manufacturing problems received tremendous interest from the operations research (OR) and management science (MS) researchers. Many books and textbooks have been written and several journals are dedicated to these subject. These topics are part of the curriculum in various industrial, mechanical, manufacturing, or management programs.

In the past, maintenance problems received little attention and research in this area did not have much impact. Today, this is changing because of the increasing importance of the role of maintenance in the new industrial environment. Maintenance, if optimized, can be used
as a key factor in organizations efficiency and effectiveness. It also enhances the organization's ability to be competitive and meets its stated objectives.

The research in the area of maintenance management and engineering is on the rise. Over the past few decades, there has been tremendous interest and a great deal of research in the area of maintenance modeling and optimization. Models have been developed for a wide variety of maintenance problems. Although the subject of maintenance modeling is a late developer compared to other area like production systems, the interest in this area is growing at an unprecedented rate.

The purpose of this chapter is to give a brief overview of the research areas of maintenance modeling. It is intended as a first informative introduction to the important areas of maintenance modeling and as a foundation to suggest useful directions for future developments. The area of maintenance modeling and optimization represents an opportunity for making significant contributions by the OR and MS communities. It should be made clear at the outset that this chapter is not meant to be a complete review of maintenance models. It is intended to simply give some ideas about the general areas of maintenance modeling illustrated using basic models.

This chapter is organized as follows. Preventive maintenance related models are discussed in Section 2. These include inspection, replacement, preventive and condition-based maintenance. Issues related to maintenance planning such as maintenance capacity planning, planning and scheduling, and spare parts provisioning are presented in Section 3. Section 4 deals with integrated models of maintenance, production, and quality. Future research directions are outlined in Section 5.

2. MAINTENANCE POLICIES

Maintenance strategies can be classified into three categories:

1. Breakdown maintenance. Replacement or repair is performed only at the time of failure. This may be the appropriate strategy in some cases, such as when the hazard rate is constant and/or when the failure has no serious cost or safety consequence or it is low on the priority list.

2. Preventive maintenance (PM) where maintenance is performed on a scheduled basis with scheduled intervals often based on manufacturers' recommendations and past experience with the equipment. This may involve replacement or repair, or both.