Preface

Modern societies depend on the smooth operation of many complex systems (designed and built by humans) that provide a variety of outputs (products and services). These include transport systems (trains, buses, ferries, ships and aeroplanes), communication systems (television, telephone and computer networks), utilities (water, gas and electricity networks), manufacturing plants (to produce industrial products and consumer durables), processing plants (to extract and process minerals and oil), hospitals (to provide services) and banks (for financial transactions) to name a few.

Every system built by humans is unreliable in the sense that it degrades with age and/or usage. A system is said to fail when it is no longer capable of delivering the designed outputs. Some failures can be catastrophic in the sense that they can result in serious economic losses, affect humans and do serious damage to the environment. Typical examples include the crash of an aircraft in flight, failure of a sewerage processing plant and collapse of a bridge. The degradation can be controlled, and the likelihood of catastrophic failures reduced, through maintenance actions, including preventive maintenance, inspection, condition monitoring and design-out maintenance. Corrective maintenance actions are needed to restore a failed system to operational state through repair or replacement of the components that caused the failure.

Maintenance has moved from being an engineering activity after a system has been put into operation into an important issue that needs to be addressed during the design and manufacturing or building of the system. Maintenance impacts on reliability (a technical issue) with serious economic and commercial implications. This implies that operators of complex systems need to look at maintenance from an overall business perspective that integrates the technical and commercial issues in an effective manner.

The literature on maintenance is vast. Over the last 50 years, there have been dramatic changes due to advances in the understanding of the physics of failure, in technologies to monitor and assess the state of the system, in computers to store

and process large amounts of relevant data and in the tools and techniques needed to build model to determine the optimal maintenance strategies.

The aim of this book is to integrate this vast literature with different chapters focusing on different aspects of maintenance and written by active researchers and/or experienced practitioners with international reputations. Each chapter reviews the literature dealing with a particular aspect of maintenance (for example, methodology, approaches, technology, management, modelling analysis and optimisation), reports on the developments and trends in a particular industry sector or, deals with a case study. It is hoped that the book will lead to narrowing the gap between theory and practice and to trigger new research in maintenance.

The book is written for a wide audience. This includes practitioners from industry (maintenance engineers and managers) and researchers investigating various aspects of maintenance. Also, it is suitable for use as a textbook for postgraduate programs in maintenance, industrial engineering and applied mathematics.

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