

---

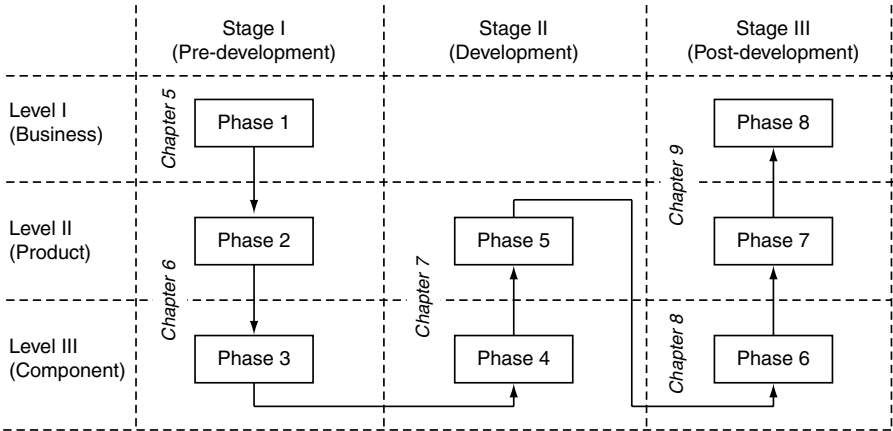
## Preface

In modern industrial societies, new products appear on the market at an ever-increasing pace. This is due to (i) rapid advances in technology and (ii) constantly increasing demands from customers, with each as a driver to the other. As a result, products are getting more complex and the performance capabilities are increasing with each new product generation.

Product reliability is an indicator that the product will perform satisfactorily over its intended useful life when operated normally. It is of great interest to both customers and manufacturers. From a customer perspective, poor product reliability increases the frequency of failures and implies higher maintenance costs over the life of the product. From a manufacturer perspective, poor reliability affects sales through customer dissatisfaction, results in higher warranty costs, and affects the reputation and the bottom line. Often, the inability of a product to perform satisfactorily can have safety implications. In this case, product reliability needs to be viewed from a societal perspective.

Product reliability is determined by the technical decisions made during the design, development, and production phases of the product life cycle, and has commercial implications for the marketing and post-sale support phases of the product life cycle. Product reliability decisions need to be made from an overall business perspective using a product life cycle framework and an approach which links the various technical and commercial issues.

A life cycle framework for decision making regarding product reliability is proposed in this book. The framework comprises three stages (pre-development, development, and post-development), three levels (business, product, and component), and eight phases (phases 1–8) as indicated in Figure 0.1. A new approach to product reliability performance and specification is proposed based on the life cycle framework. The approach involves defining the desired performance and deriving the specifications that will ensure this performance in a sequential manner. Mathematical models are used to obtain predicted performance and to compare the predicted performance with the desired performance. Using the specifications at the component level of phase 3, the predicted performance is assessed in phases 4–8 for proper decision making regarding product reliability, over the product life cycle.



**Figure 0.1.** Framework for decision making regarding product reliability

In stage I of the life cycle, two important questions need to be answered:

- 1. How to decide on desired reliability performance at the product level?
- 2. How to specify the reliabilities at the component level that will ensure this?

The answer to the first question depends on the decisions in phases 1 and 2 and the answer to the second question depends on the decisions made in phases 2 and 3 of the proposed framework.

During stage I, the product is a concept that mainly exists as drawings and associated calculations and assessments. Here, the product performance must be predicted based on mathematical models, generic data, and expert judgement. In stage II, physical models and prototypes are built, tested, and evaluated; and in stage III, the product is manufactured and used by the customers. In stages II and III, the actual performance of the product can be determined based on observed data and can be compared with the desired performance.

The book deals with the framework and the approach needed for effective decision making regarding product reliability. It deals with both standard and custombuilt products, highlighting the commonality and the difference between the two.

The book is aimed at both practitioners and researchers involved with reliability. The objectives are to provide (i) senior managers in industry a better view to make proper decisions relating to product reliability, (ii) design engineers an approach to deal effectively with reliability design, and (iii) reliability researchers a starting point to carry out new research into various aspects of product reliability.

Finally, the book can also be used as a reference book for postgraduate programmes in engineering design, reliability, and management.

The book has 11 chapters of which the first four give an overview and an introduction to the many aspects of product reliability. Although we have tried to make the book self-contained, it is aimed primarily at readers with basic knowledge and/or experience in product reliability. For reference, a brief introduction to reliability the-

ory is given in Chapter 4. The eight phases of the new framework are described and discussed in Chapters 5 to 9 as indicated in Figure 0.1. Product safety aspects are discussed in Chapter 10 and reliability management systems are discussed in Chapter 11. Two case studies are used throughout the book to illustrate main aspects of product reliability. The first case is a cellular phone, which illustrates aspects related to standard products, or consumer durables. This case study is discussed in several small examples and as a last section in Chapters 4 to 10, where we highlight main issues in the chapter, and give references where interested readers can find more information. The second case is a safety instrumented system, for example a process shutdown system, which illustrates reliability aspects of custom-built, or specialized, products. This case study is included as several small examples illustrating central reliability issues.

The descriptions in the book are rather brief, but a large number of references are provided where interested readers can find more details and extend their knowledge. Symbols used in the book are listed and explained in Appendix A. Acronyms are listed in Appendix B and a glossary is supplied in Appendix C.

Brisbane and  
Trondheim,  
March 2008

*Pra Murthy*  
*Marvin Rausand*  
*Trond Østerås*

Product Reliability

Specification and Performance

Murthy, D.N.P.; Rausand, M.; Østerås, T.

2008, XVII, 284 p., Hardcover

ISBN: 978-1-84800-270-8