



# Practical Reliability Engineering and Analysis for System Design and Life-Cycle Sustainment

*William Wessels*

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In today's sophisticated world, reliability stands as the ultimate arbiter of quality. An understanding of reliability and the ultimate compromise of failure is essential for determining the value of most modern products and absolutely critical to others, large or small. Whether lives are dependent on the performance of a heat shield or a chip in a lab, random failure is never an acceptable outcome.

Written for practicing engineers, **Practical Reliability Engineering and Analysis for System Design and Life-Cycle Sustainment** departs from the mainstream approach for time to failure-based reliability engineering and analysis. The book employs a far more analytical approach than those textbooks that rely on exponential probability distribution to characterize failure. Instead, the author, who has been a reliability engineer since 1970, focuses on those probability distributions that more accurately describe the true behavior of failure. He emphasizes failure that results from wear, while considering systems, the individual components within those systems, and the environmental forces exerted on them.

## **Dependable Products Are No Accident: A Clear Path to the Creation of Consistently Reliable Products**

Taking a step-by-step approach that is augmented with current tables to configure wear, load, distribution, and other essential factors, this book explores design elements required for reliability and dependable systems integration and sustainment. It then discusses failure mechanisms, modes, and effects—as well as operator awareness and participation—and also delves into reliability failure modeling based on time-to-failure data considering a variety of approaches.

From there, the text demonstrates and then considers the advantages and disadvantages for the stress-strength analysis approach, including various phases of test simulation. Taking the practical approach still further, the author covers reliability-centered failure analysis, as well as condition-based and time-directed maintenance.

As a science, reliability was once considered the plaything of statisticians reporting on time-to-failure measurements, but in the hands of a practicing engineer, reliability is much more than the measure of an outcome; it is something to be achieved, something to quite purposely build into a system. Reliability analysis of mechanical design for structures and dynamic components demands a thorough field-seasoned approach that first looks to understand why a part fails, then learns how to fix it, and finally learns how to prevent its failing. Ultimately, reliability of mechanical design is based on the relationship between stress and strength over time. This book blends the common sense of lessons learned with mechanical engineering design and systems integration, with an eye toward sustainment. This is the stuff that enables organizations to achieve products valued for their world-class reliability.

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