

BOOK REVIEW

Peter J. Blau¹

Review of: *Wear Analysis for Engineers*²

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The objective and intended audience for this book are clearly stated in the Preface: “This book is intended to explain the wear analysis method and its implementation and to provide sufficient information for the performance of most wear analyses. It is intended primarily for engineers.” Perhaps, the phrase “author’s wear analysis method,” should probably be substituted in place of “the wear analysis method,” which implies that there is only one. In fact, there are several handbooks and tribology texts on the market today that describe some form of wear analysis. While the author’s approach shares many key attributes with the others, it represents a unique perspective gained after 40 years of experience in the field of tribology. The approach he provides is sufficiently general to cover a wide range of wear problems.

The book is organized into eight chapters and five appendices that contain a number of data tables and equations. There is also a consolidated reference list and a glossary of terms to describe wear mechanisms. Chapter 1 overviews the author’s wear analysis process. It involves examination, characterization, modeling and evaluation, and testing. Each of these four steps and the process of implementing them are described in general terms.

The reviewer logically expected the next chapters to describe each of these stages, but that was not the case. In fact, Chapter 3 is called “Examination Methods” and Chapter 4 is titled “Characterization Methods,” but there were no chapters called “Modeling and Evaluation” or “Testing.” In that sense, the format of the book did not explicitly parallel the scheme that was outlined in Chapter 1, even though the basic elements of that scheme can be found. Thus, the principal criticism of this book is from the standpoint of organization. Rather than follow the stage set in Chapter 1, Chapter 2 on “Basic Tribology” takes a step backward in a sense to review the fundamental concepts of friction, lubrication, and wear. While the book is not focused on friction or lubrication, these summaries are nicely written and provide information that is useful in conducting a wear analysis.

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¹ Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN 37831-6063.

² *Wear Analysis for Engineers*, Raymond G. Bayer, HNB Publishing, New York, December 2001. Cloth, 300 pp., \$67.00. ISBN: 0-9664286-5-X.

I was particularly pleased to see a nice discussion of impact wear in Section 2.5 on “Wear Situations.” Impact wear is an important form of surface damage that is commonly left out of tribology books and wear-related journal publications. On the other hand, departing from most conventional classifications, Bayer considers erosive wear to be a form of abrasive wear, and consequently, its brief description is embedded in section 2.5.4 on “Abrasive Wear Situations.” Fretting wear is a special form of reciprocating sliding wear (low amplitude) but it isn’t mentioned in Section 2.5. Rather, it is discussed later in Chapter 7 under “Special Considerations.”

The recurring treatment of wear mechanisms with slightly different viewpoints could be confusing to the lay reader. For example, Chapter 1 contains a figure showing equations used for modeling nine types of wear. Section 2.2 on “Wear Mechanisms” has a table that lists 38 terms to describe wear behavior and mechanisms as well as another table and a discussion that elaborates on eight “generic wear mechanisms.” In fact, Table 4.2.1 in Chapter 4 and the “Glossary of Wear Mechanisms” in the back of the book lists and defines 88 terms related to different wear mechanisms.

Chapters 3 on “Examination Methods” and Chapter 4 on “Characterization Methods” present good, balanced overviews. It was gratifying to see reference to metallographic cross sections as an aid to diagnosing wear problems. On the other hand, Chapter 5 on “Phenomenological Considerations” seems to revisit issues that are discussed in other parts of the book. The material in that short, 12-page chapter should probably have been redistributed into sections within other chapters that discuss similar topics.

Bayer’s approach to wear analysis involves applying equations to model and quantify wear problems. While equations describing different types of wear may be found throughout the book, the heart of that approach is found in Chapter 6 on “Analytical Methods.”³ Descriptions of mathematical relationships relevant to the different forms of wear are nicely documented with appropriate comments based on practical experience. It was particularly refreshing to the reviewer to find an acknowledgment and discussion of the roles of run-in and transitions in modeling wear behavior. These important subjects are often omitted from academic treatises of wear, but are quite important for understanding the behavior of real tribosystems.

As one who has wrestled with wear issues over the years, I found Chapter 8 on “Wear Analysis Examples” to be particularly valu-

³ There are two typos in the Table of Contents showing Chapter 3 beginning on page 126, but it begins on 124. Also, Chapter 6 is shown as beginning on page 181, but it actually begins on page 176.

able because it exposes the author's thinking in analyzing specific wear problems. It has four excellent examples, the first of which involves applying wear analysis in the design stage, and the latter three illustrate the solutions to actual wear problems. Scientific papers centuries ago were written much in the form of a diary in which the investigator's thinking process was revealed. Because Bayer's Chapter 8 is written in that logical style, I found it most interesting.

Collected data in the appendices provide the reader with an appreciation of the magnitudes of various wear-related quantities and how they differ between material systems. For the contact geometry-related equations, more rapid comprehension could have been aided by including a few simple figures. The definition of geometric quantities in words sometimes required several rereadings to understand.

The reviewer approached this book as an engineer with a wear

problem who needs an answer urgently and who wants to expend as little time and effort as possible to get it. In that context, Bayer's book should not be treated as a handbook in which one can simply scan the index and jump to a section that contains the relevant data or equations. Rather, it is more like a textbook. Proper use of this book requires study, because the author's process of wear analysis involves a sequence of steps, each of which requires a commitment to read and understand the material.

Wear Analysis for Engineering is a useful book. Its main drawback seems to be in the somewhat nonintuitive (to the reviewer) organizational scheme, and the repetition of similar-appearing information, like wear mechanism descriptions or equations in different sections of the book. However, the author has considerable wisdom to share, and if one devotes sufficient time to studying the examples in this book, he or she will gain valuable, practical tools for solving real wear problems.