Journal of Tribology

Book Review

Engineering Tribology, by J. A. Williams, Oxford University Press.

REVIEWED BY FRANCIS E. KENNEDY[1]

This broad-based tribology textbook was first published in 1994 and was reprinted in paperback form with corrections in 1996. It was written as a textbook for final year undergraduates and first-year graduate students in mechanical engineering, but should serve a much wider audience. It is a well written and comprehensive book dealing with tribological phenomena that students and researchers in a wide variety of areas should find of interest.

The book starts off with an introduction to the terminology used in the field of tribology and in the book. There is also a brief historical background. The types of lubricants and their physical properties are introduced, although that subject is treated briefly and could be supplemented by more information on additives and lubricant chemistry. The second chapter presents a good introduction to surface roughness and its measurement. There is also an introduction to surface engineering. That topic could be complemented by other material to provide more complete coverage, particularly in the area of modern surface coatings and nanotribology. Chapter 3 presents a very good treatment of the mechanics of contacting surfaces. Among the topics covered are line contact, semi-elliptical Hertzian contact, contact between rough surfaces, and elastoplastic contact. Effects of frictional heating are also introduced. Then the mechanisms of solid metallic friction are introduced, following the approach of Bowden and Tabor. There are brief treatments of friction of polymers, elastomers and ceramics. Chapter 5 provides a good treatment of wear mechanisms for metals. The wear of non-metallic materials is not covered.

There are four chapters dealing with lubrication and bearings. The first of these covers hydrostatic bearings and presents the governing equations of externally pressurized thrust and journal bearings and the application of those equations in bearing design. This is followed by a chapter in which the fundamentals of self-acting hydrodynamic lubricant films are presented. This begins with the 1-dimensional Reynolds equation and its application to slider pad bearings and follows with a treatment of the 2-dimensional Reynolds equation, with application to disc and journal bearing lubrication. Dynamic effects in squeeze films and journal bearings are introduced. The following chapter presents a reasonably complete introduction to gas lubrication, including a discussion of dynamic instabilities in rotating gas bearings. There is also an introduction to elastohydrodynamic lubrication, with emphasis on line contacts. This could be supplemented by more information about EHL for point (or elliptical) contacts. There is a brief introduction to rheology of non-Newtonian lubricants. The final lubrication chapter deals with boundary and solid lubricants. The former is treated more completely than the latter. An introduction to metalworking tribology is included.

The final two chapters present practical applications of tribological concepts. The first of these deals with dry sliding and mixed lubrication (brakes, clutches, seals, porous bearings), while the second deals with rolling contacts (rolling element bearings, tires).

Throughout the book, the author has taken a broad view of the subject of tribology and has presented the material in a pedagogically sound manner. He has provided good problems to accompany each chapter, and answers are given for all of them. Therefore, the book serves very well as a textbook for engineering students. It is less biased toward any one aspect of tribology than other textbooks on the subject, so is most suitable for a general introductory course. It should also be of interest to anyone who wishes to learn the fundamentals of tribology, so should be on the shelves of libraries in industrial organizations, research laboratories and engineering schools.

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