TRIBOLOGY: FRICTION, LUBRICATION, AND WEAR, Edited by A. Z. Szeri, Hemisphere Publishing Company, New York, 1980, 548 pp.

REVIEWED BY STEVE M. ROHDE[1]

Tribology: Friction, Lubrication, and Wear is a compilation of eleven chapters dealing with both practical and research topics in tribology. These chapters, prepared by leading authorities in their respective fields, are based upon a graduate level course given at the University of Pittsburgh.

The first two chapters, an introduction and a chapter discussing friction and wear, are written by the editor and R. A. Burton, respectively, and provide an excellent introduction to tribology in the full sense of the word. Hydrodynamic and elastohydrodynamic lubrication are introduced as well as the modern concepts of surface contact, friction, and wear. These chapters are followed by chapters dealing with liquid film lubrication and gas bearings, written by A. Z. Szeri and C. H. T. Pan, respectively. Hydrostatic and hydrodynamic lubrication are discussed in the former chapter. Emphasis in that chapter is placed on the physics of fluid film lubrication and the formulation of the governing field equations. In this regard, a clear discussion of boundary conditions for Reynolds equation is provided. Although some representative nondimensional bearing characteristics for thrust and journal bearings are given, extensive design information is not presented; this was not the intent of the chapter. The parallel chapter dealing with gas bearings provides an interesting historical account of gas bearing technology and application as well as detailed mathematical derivations of the governing field equations. Canonical solutions for infinitely long and externally pressurized bearings are presented as well as perturbation, short and long bearing approximations. Time and frequency dependent phenomena are also treated.

Turbulence, inertia, and thermal effects in fluid film bearings are discussed in a chapter by A. Z. Szeri. As these fields have progressed quite rapidly during the last decade, this chapter probably provides the most up to data treatment of these subjects. Particular topics treated include flow transition, turbulent lubrication models, and thermohydrodynamic lubrication.

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Chapters on computational techniques for solving fluid film lubrication problems, written by the reviewer, and on rotor bearing dynamics, written by C. H. T. Pan, complete the more "analytical" section of the volume. The intent of the former chapter is to present different computational methods suitable for the solution of large classes of lubrication problems including gas film, thermohydrodynamic and elastohydrodynamic problems. The chapter on rotor bearing dynamics represents a good introduction to this subject. Starting with the elementary concept of a constrained mass point, the author goes on to discuss dynamic coupling mechanisms, bearing and rotor system stability.

The chapter on rolling element bearings by W. J. Anderson provides both an excellent introduction to the subject and a guide to the practical considerations associated with the use of rolling element bearings. In particular, friction, stress, and lubrication considerations are discussed in detail.

The use of liquids, solids, semi-solids, and gases as lubricants is the subject of a chapter on lubricants by L. B. Sargent. The inclusion of such topics as the role of additives in oil; synthetic lubricants; and health, safety, and toxicity effects should make this chapter of particular interest to practicing engineers involved in lubricant selection.

The final two chapters, written by H. N. Kaufman, deal with bearing materials and damage analysis. Characteristics of different bearing alloys are presented and discussed in detail as are the characteristics of nonmetallic bearing materials and their applications. Although a large portion of the bearing material chapter deals with the selection of materials for fluid film or boundary lubrication applications, a small section is devoted to bearing materials for rolling-element bearings. The final chapter is devoted to bearing damage analysis. Fatigue, corrosion, wear, wiping, and erosion damage are discussed, and photographs showing these types of damage are given. This chapter should be particularly useful for the practicing engineer who is interested in determining why a bearing failed in a specific application.

In summary, *Tribology: Friction, Lubrication, and Wear* represents a modern broad treatment of the theory and practice of tribology. This text (or sections thereof) should be ideal for use in a graduate or advanced undergraduate course, either as the main text or as a supplement. Likewise, this book should also prove to be an excellent reference for the practicing engineer or researcher.