PREFACE

This textbook on Tribology, or Lubrication and Wear, as the subject was previously called, is the outcome of research and teaching by the authors over many years to undergraduate mechanical engineering students at Imperial College, London and Loughborough University. The book represents our ideas on how Tribology should be taught to modern engineering students who, unlike their predecessors, now generally have at their disposal the support of comprehensive computer systems. We hope the book will also be of use to practicing engineers who frequently encounter Tribology-centered problems, and who require quick, but adequate solutions.

Below is a summary of our approach to the teaching of Tribology:

- Because Tribology covers such a broad field, embracing engineering surfaces, through to their dry contact friction and finally fluid film lubrication, we have attempted to explain it in such a way that we demonstrate to the reader that there is often a close interaction between these distinct disciplines.
- The beginnings of some chapters introduce the reader to historical examples of Tribology and its economic impact on society as well as its engineering relevance.
- When discussing the properties of lubricants we had noted that in the past specially scaled graph paper was often needed. Our approach is to assume that none is available and only well-known empirical expressions describing lubricant behavior must be used instead. Some of these expressions can easily be employed in numerical solutions by using the widely available Mathcad or similar software.
- The book shows you how to develop simple mathematical models that can be used to find approximate solutions to Tribology related problems. For example, where fluid flow theory must first be employed, we show you how to derive an incomplete form of Reynolds equation using only the physics of lubricant flow theory. The relative significance of each of the variables involved in a complete solution then becomes immediately apparent.

- When we arrive at hydrodynamic bearing design, for a realistic solution, temperature effects should be included. In the case of a complete thrust bearing there is no point in studying an isolated wedge pair, as its performance is only of academic interest in the design process. Instead, the pair is studied in the context of the *whole* bearing, again helped by Mathcad, when seeking an approximate numerical solution.
- The worked examples and chapter questions set throughout the book are not always of the sterile examination type, where only substitution in a formula is needed for a solution. Instead, a computer program is occasionally necessary in order to solve a set of nonlinear governing equations. Again Mathcad does this rapidly in a few lines, using its vectorize and graphing facilities. Additionally, it shows you visually where there has been poor convergence, usually suggesting an unsatisfactory choice of some design variables.
- Where difficult Mathematics is encountered, we only summarize the procedure sufficiently for the reader to obtain the gist of the solution method before utilizing the resulting simplified equations. On other occasions, a regression formula resulting from a numerical solution derived elsewhere may be used.
- There are also chapters on Bio-Tribology (contributed by Professor Duncan Dowson) and an introduction to the recent science of Nano-Tribology.
- Finally, there is a chapter on fluid film lubrication applied to internal combustion engines. It demonstrates that in the real world, Tribology problems are often not as straightforward as those set in an engineering undergraduate course. Nevertheless, utilizing the equations supplied in the book, approximate numerical solutions may be obtained.
- There are solved examples in each chapter, supplanted by questions at the end of the book. A Book of Solutions is also provided at the end of the book, dealing with most of the set questions.

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