Preface

This textbook is intended mainly for use in undergraduate engineering courses in thermodynamics, and it covers all the topics that are traditionally taught in such courses. A novel feature of the book is the inclusion of a series of worked examples in each chapter. These examples are carefully chosen to expose students to diverse applications of engineering thermodynamics. In particular, care has been taken not to repeat the same type of example, with different numerical values, which would only increase the number of problems presented. Each worked example is designed to illustrate the application of an important concept introduced in the chapter to a practical situation. At the end of each chapter there are an additional series of problems for which numerical answers are provided. For the instructor, this book should provide a useful source for problems, to be included in tutorials and illustrations in courses.

The first two chapters on systems and thermodynamic properties provide the groundwork for applying the laws of thermodynamics. The third chapter on work interactions, builds on the concepts studied in basic mechanics courses. Chapters 4 and 5 present the application of the first law to closed and open systems respectively. The second law is developed in chapter 6, following the historical route that uses heat engines. The property, entropy, emerges as a consequence of the second law in chapter 7. The analysis of open systems, using the first law and the second law, is presented in chapter 8. The analysis of vapor power cycles, gas power cycles, and refrigeration systems are included in chapters 9, 10 and 11 respectively. Chapter 12 deals with non-reactive mixtures, which have important applications in air conditioning. The

emphasis in the final chapter on reactive mixtures is on combustion processes.

Due to the close connectedness of the topics in thermodynamics, a majority of the worked examples in earlier chapters 1, 2 and 3 could have been extended to the application of the first and second laws in later chapters, thereby generating additional worked examples. I have avoided doing this, which at first sight might appear as a lost opportunity. However, I have deliberately left this useful avenue, for extending the examples, open to the user of the book.

I was fortunate to have had the opportunity to teach a number of courses in thermodynamics, energy conversion, refrigeration and air conditioning, at the Department of Mechanical Engineering, National University of Singapore (NUS). The notes developed for these courses provided the framework and much of the material for this book. I am thankful to my colleagues in the energy and bio-thermal division at NUS, with whom I shared the teaching of these courses, for many valuable discussions on the applications of thermodynamics.

I wish to thank Professor Terry Hollands who willingly reviewed an early draft of the book. I benefited much from his insightful comments and suggestions on the content, and presentation of the subject matter. I am thankful to Dr. Raisul Islam who helped produce the illustrations in the first three chapters of the book. Thanks are due to my sons, Duminda and Harindra, and my daughters-in-law, Sindhu and Sophia, for their encouragement and help in different ways.

Finally, my heartfelt thanks are given to my wife Kamani for her constant encouragement and generous support towards the completion of this project. This book is dedicated to her.

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