

Turbomachinery

Design and Theory

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To my parents, Tirupelamma and Subba Reddy Gorla,
who encouraged me to strive for excellence in education

—R. S. R. G.

To my wife, Tahseen Ara,
and to my daughters, Shumaila, Sheema, and Afifa

—A. A. K.

Preface

Turbomachinery: Design and Theory offers an introduction to the subject of turbomachinery and is intended to be a text for a single-semester course for senior undergraduate and beginning graduate students in mechanical engineering, aerospace engineering, chemical engineering, design engineering, and manufacturing engineering. This book is also a valuable reference to practicing engineers in the fields of propulsion and turbomachinery.

A basic knowledge of thermodynamics, fluid dynamics, and heat transfer is assumed. We have introduced the relevant concepts from these topics and reviewed them as applied to turbomachines in more detail. An introduction to dimensional analysis is included. We applied the basic principles to the study of hydraulic pumps, hydraulic turbines, centrifugal compressors and fans, axial flow compressors and fans, steam turbines, and axial flow and radial flow gas turbines. A brief discussion of cavitation in hydraulic machinery is presented.

Each chapter includes a large number of solved illustrative and design example problems. An intuitive and systematic approach is used in the solution of these example problems, with particular attention to the proper use of units, which will help students understand the subject matter easily. In addition, we have provided several exercise problems at the end of each chapter, which will allow students to gain more experience. We urge students to take these exercise problems seriously: they are designed to help students fully grasp each topic

and to lead them toward a more concrete understanding and mastery of the techniques presented.

This book has been written in a straightforward and systematic manner, without including irrelevant details. Our goal is to offer an engineering textbook on turbomachinery that will be read by students with enthusiasm and interest—we have made special efforts to touch students' minds and assist them in exploring the exciting subject matter.

R.S.R.G. would like to express thanks to his wife, Vijaya Lakshmi, for her support and understanding during the preparation of this book. A.A.K. would like to extend special recognition to his daughter, Shumaila, a practicing computer engineer, for her patience and perfect skills in the preparation of figures; to Sheema Aijaz, a civil engineer who provided numerous suggestions for enhancement of the material on hydraulic turbomachines; and to M. Sadiq, who typed some portions of the manuscript. A.A.K. is also indebted to Aftab Ahmed, Associate Professor of Mechanical Engineering at N.E.D. University of Engineering and Technology, for his many helpful discussions during the writing of this book.

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*Rama S. R. Gorla
Aijaz A. Khan*

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