

Preface to the Fourth Edition

It is now twenty years since the third edition of this book was published and in that period many advances have been made to the art and science of turbomachinery design. Knowledge of the flow processes within turbomachines has increased dramatically resulting in the appearance of new and innovative designs. Some of the long-standing, apparently intractable, problems such as surge and rotating stall have begun to yield to new methods of control. New types of flow machine have made their appearance (e.g. the Wells turbine and the axi-fuge compressor) and some changes have been made to established design procedures. Much attention is now being given to blade and flow passage design using computational fluid dynamics (CFD) and this must eventually bring forth further design and flow efficiency improvements. However, the fundamentals do not change and this book is still concerned with the basics of the subject as well as looking at new ideas.

The book was originally perceived as a text for students taking an Honours degree in engineering which included turbomachines as well as assisting those undertaking more advanced postgraduate courses in the subject. The book was written for engineers rather than mathematicians. Much stress is laid on physical concepts rather than mathematics and the use of specialised mathematical techniques is mostly kept to a minimum. The book should continue to be of use to engineers in industry and technological establishments, especially as brief reviews are included on many important aspects of turbomachinery giving pointers to more advanced sources of information. For those looking towards the wider reaches of the subject area some interesting reading is contained in the bibliography. It might be of interest to know that the third edition was published in four languages.

A fairly large number of additions and extensions have been included in the book from the new material mentioned as well as “tidying up” various sections no longer to my liking. Additions include some details of a new method of fan blade design, the determination of the design point efficiency of a turbine stage, sections on centrifugal stresses in turbine blades and blade cooling, control of flow instabilities in axial-flow compressors, design of the Wells turbine, consideration of rothalpy conservation in impellers (and rotors), defining and calculating the optimum efficiency of inward flow turbines and comparison with the nominal design. A number of extensions of existing topics have been included such as updating and extending the treatment and application of diffuser research, effect of prerotation of the flow in centrifugal compressors and the use of backward swept vanes on their performance, also changes in the design philosophy concerning the blading of axial-flow compressors. The original chapter on radial flow turbines has been split into two chapters; one dealing with radial gas turbines with some new extensions and the other on hydraulic turbines. In a world striving for a ‘greener’ future it was felt that there would now be more than just a little interest in hydraulic turbines. It is a subject that is usually included in many mechanical engineering courses. This chapter includes a few new ideas which could be of some interest.

A large number of illustrative examples have been included in the text and many new problems have been added at the end of most chapters (answers are given at the end of the book)! It is planned to publish a new supplementary text called Solutions Manual, hopefully, shortly after this present text book is due to appear, giving the complete and detailed solutions of the unsolved problems.

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