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Heat and Mass Transfer in Rotating Machinery

Eds D. E. Metzger and N. H. Afgan

During the last two decades heat transfer problem solving has become increasingly important to the design of gas turbine aero-engines. These engines are characterised by their high power concentration and low specific fuel consumption, leading to low weight, small size, high thrust-to-weight ratio and low operational fuel consumption. In civil engines fuel consumption is of paramount importance, such that today's advanced technology high bypass ratio engines result in about 40% less fuel per passenger seat being consumed than was the case ten or more years ago. There are two major factors contributing to these achievements: high compression ratio and turbine entry temperature giving high thermal efficiency and power density. As a consequence the heat transfer engineer has become much more important in the design of aero-engines and research efforts into heat transfer and associated mass transfer problems have intensified.

The International Centre for Heat and Mass Transfer in Belgrade, Yugoslavia, organised a symposium in September 1982, of which this book is the proceedings. Metzger was Chairman of the Symposium Committee and Afgan is the Scientific Secretary to ICHMT. The general format of the book is much the same as the symposium in which the papers have been organised into the generic research areas; rotating tubes and channels (6 papers), rotating surfaces and enclosures (11 papers), experimental techniques (8 papers), gas turbines (10 papers), steam turbines (6 papers) and rotating heat pipes and thermosyphons (6 papers). The contents of the papers are of excellent quality and cover in depth major areas of

interest in the transfer of heat and mass in rotating machinery.

Conclusions to be drawn from the book are that whereas it has been traditional for the heat transfer engineer to concentrate his activities on the cooling of 'hot parts', notably the combustor and turbine, he now has responsibilities for the thermal behaviour of all other parts, including the 'cold parts' such as the fan, compressor, labyrinth seals, bearings, etc. The heat transfer tasks involved in major engine components are such that nearly all aspects of heat transfer technology are met in aero-engines, and this is clear from the contents of the papers presented and the generic format of the book. Detailed models of heat transfer processes still remain to be developed and many phenomena are not fully understood, so continued research of the kind described in the book is called for.

The book covers many aspects of design development and research in rotating machinery. It is a timely and valuable addition to the engine designer and heat and mass transfer research worker.

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