

Modern Developments *in* Heat Transfer

Edited by

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Preface

The rapid developments within the body of scientific knowledge called heat transfer represent, in microcosm, a phenomena encountered throughout science and technology. Two important aspects emerge. One, cited so frequently as to be commonplace, is the active involvement of physicists, chemists, and mathematicians in activities usually considered to be the responsibility of engineers, and vice versa, with the result that the lines once clearly separating them have blurred to the vanishing point. A second aspect is the increased involvement of scientists whose previous connection with the field of heat transfer was at most tenuous. This has grown to the extent that journals of biology, physiology, and zoology have become channels for the reporting of heat transfer investigations, in addition to the more familiar journals of chemistry, physics, and engineering. The problems under investigation range from blood flow to desalinization of sea water, the temperature range extending from the vicinity of absolute zero to that of the stars, the environment varying from the earth's interior to outer space.

Against this background, the gathering of heat transfer workers for the International Heat Transfer Conference in August, 1961 presented a unique opportunity to arrange a short but intensive course treating recent developments in certain vital sectors of this expanding field of heat transfer. Appropriately, the Heat Transfer Laboratory of the University of Minnesota was completing its tenth year under the direction of Dr. E. R. G. Eckert. The willingness of many of the contributors to prepare lectures, travel by somewhat circuitous routes, and labor over manuscript, galley, and page proofs is, of course, appropriate recognition of Dr. Eckert's contributions to the field of heat transfer and the high regard in which he is held by his colleagues.

Arrangement of the contributions is by chapters; each chapter is

integral and distinct but grouped according to broad categories such as convective heat transfer, heat and mass transfer, radiation heat transfer, and properties and aspects of high temperature heat transfer. No attempt was made to establish uniformity in nomenclature and units among the chapters since each contains a list of symbols at the end; the units of the various quantities are identified in the text and on the figures. In some instances, the contributions review and summarize work in particular areas, including the most recent developments, with the result that the reader is acquainted with the path leading to the best design and analysis currently available as well as conclusions likely to come from research in progress. In other instances, the contributions report findings of research for the first time. The result, hopefully, is one that should find a wide interest among our heat transfer colleagues.

Acknowledgments for a volume of collected works are necessarily manifold. The editor would begin by expressing his gratitude to the various authors, for their work has made the volume possible. Their understanding participation and cooperation has marked the project from its inception and afforded the editor a pleasant experience not likely to be repeated. Registrants in the course brought their own special knowledge of heat transfer, and a spirit of informed inquiry that stimulated a rewarding exchange of information and ideas. The staff of the Heat Transfer Laboratory, past and present, assisted in a variety of ways before and after the course; especial thanks are due Drs. J. P. Hartnett and T. F. Irvine, Jr., for their pioneer effort in planning the initial course in 1958. The Staff of the University of Minnesota Center for Continuation Study under Dean J. M. Nolte assisted expertly in providing facilities for the course, registrants, and staff; detailed arrangements were ably accomplished by Messrs. M. K. Cragun and G. W. Remington. The site of the course was the University of Minnesota's Duluth Campus, whose staff, one and all, under Provost R. W. Darland, extended a warm hospitality which contributed materially to the success of the course, and shall be long remembered.

The Heat Transfer Laboratory of the Mechanical Engineering Department of the University of Minnesota began in the fall of 1951 with the appointment of Dr. E. R. G. Eckert as Professor of Mechanical Engineering. During the following decade the laboratory achieved a measure of recognition for the scope and quality of its scientific work and the individualism of its staff. The most recent recognition of the former was the presentation of the Max Jakob Memorial Award to

Dr. Eckert in December, 1961, graciously accepted on behalf of the laboratory.

Not fully recognized but of equal importance is the creation of an atmosphere marked by freedom of inquiry, confidence, understanding, and wise counsel. Dr. Eckert has led in creating this atmosphere and to it many investigators have been attracted. They have grown, flourished, and distinguished themselves and the laboratory by their accomplishments. They join, as colleagues and friends, with the authors and editor in dedicating this volume to Dr. E. R. G. Eckert.

WARREN IBELE

Minneapolis, Minnesota
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