A COMMEMORATIVE VOLUME IN MEMORY OF DARRELL PEPPER

FOREWORD

This special issue of Computational Thermal Sciences is dedicated to the life, legacy, and contributions of Professor Darrell W. Pepper, who passed away on October 18, 2022. Besides being a good friend, colleague, and mentor to many in the thermal engineering community, he made important and lasting contributions to the field. He is particularly well known for his work on computational heat transfer and fluid dynamics. His books on finite element methods were timely and paved the way for the use of these methods for the solution of complex heat transfer and fluid flow problems. His extensive publications, presentations, lectures, and short courses have further expanded the application of the finite element method and other computational approaches to a wide variety of practical and fundamental problems. His work has played a major role in establishing the importance and versatility of computational methods for obtaining accurate and dependable results for prediction, design, and optimization of thermal processes and systems.

Professor Pepper has contributed in many ways to the growth and development of the thermal science and engineering community around the world. He served as the Editor-in-Chief of Computational Thermal Sciences and as Associate Editor of several other international journals. In recent years, he was extensively involved with the American Society of Thermal and Fluid Engineers (ASTFE) and, as chair of two annual conferences of the society, he was instrumental in the establishment of ASTFE as an important international society focused on thermal sciences and fluids engineering. During his illustrious career, Darrell received many prestigious awards, such as the ASME Heat Transfer Memorial Award and the AIAA Energy Systems Award. He collaborated with many national labs and industries on a wide range of problems.

The papers included in this special issue are contributed by friends, colleagues, and collaborators of Professor Pepper, as well as others interested in the work carried out by him. The impact of his work was felt worldwide and many of the methods proposed by him were applied in many different areas, such as thermal systems, energy, environment, aerospace, and high-speed computing. Besides several additional methods like integral transforms and meshless methods, the papers included here cover topics such as liquid jets, sprays, shock interactions, wind turbines, natural convection, turbulence, and microchannels. A tribute to his life and contributions is also included. He was an active researcher till the very end, as seen from a paper in which he is a co-author. Certainly, the diverse topics covered in this issue reflect Darrell’s wide interests and impact on the field.

Overall, this special issue represents a timely contribution to the field of computational thermal sciences and honors one of the leaders in the field, Professor Darrell Pepper. The Editors have certainly brought a wide range of topics and researchers together to celebrate an exceptional career.

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PREFACE

Darrell Pepper was a teacher, a researcher, and an inventor. But more than all that he was a friend to many and mentor to a large number of his students and associates. He was a multi-dimensional personality with expertise in multiple fields of engineering. He was also an exceptional man. He was an exceptional man who would go out of his way to help a friend or a student. This book commemorates the life and seminal contributions of Professor Pepper in advancing the science and practice of computational fluid dynamics (CFD) and computational heat transfer (CHT).

The Navier–Stokes equations are recognized to be one of the most intractable mathematical problems in physics. Despite the equations’ broad applicability, for almost 200 years, there was no effective way to obtain an exact solution.
For practical problems, one had to rely on approximate solutions or experimental data. It is in this context that CFD arrived on the scene in late 1960’s with the advent of the electronic computer. Darrel Pepper had just graduated in 1968 and took an early interest in applying CFD to practical engineering problems.

Professor Pepper’s research, engineering and scientific activities spanned the areas of mechanical and aerospace engineering as well as atmospheric sciences. He began his teaching career as an adjunct professor and lecturer while working at E.I. DuPont de Nemours where he provided research and guidance in many areas, including heat transfer and hydrodynamics, atmospheric sciences/meteorology, and computational sciences. He also acted in the capacity of Dupont’s Savannah River Laboratory Long Range Planning and Professional and University Relations. After leaving Dupont, he became the Chief Scientist for the Marquardt Company in Van Nuys, CA, and also co-founded and served as the CEO of Advanced Projects Research, Inc., in Moorpark, CA. In these endeavors, he worked on the development and implementation of computational methods and computer codes for solving fluid dynamics, heat transfer, propulsion, and environmental problems. He also developed a set of fast hybrid finite element codes for calculating supersonic and hypersonic flows, including working on the National Aerospace Plane Program where he gave briefings to President Reagan’s Science Advisor on the application of CFD for aerospace vehicle design. He taught at the University of South Carolina and at the Georgia Institute of Technology. He moved from Akin, SC, to California, where he was a Professor of Mechanical Engineering at California State University, Northridge. He later joined the faculty at the University of Nevada, Las Vegas, where he remained for the balance of his career.

This book commemorates the life and contributions of Darrell Pepper. The editors were closely associated with Professor Pepper—one as a colleague and the other as a student and later a close research associate. The book has been assembled by former students and colleagues of Professor Pepper who were deeply influenced by his work. Most of the authors knew him personally. So, its scope is principally directed to the impact of his work. Along with the technical material on various aspects of CFD and CHT and their applications, the book contains two appendices. The first of these is a brief biography, and the second contains personal tributes from his former students and associates.

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February 28, 2024