

Foreword

In honor of Richard Chu, a symposium on “Thermal Management of Electronic Systems,” was held at the ASME IMECE in Washington DC, in November 2003, where over 45 papers were presented. This special issue of the ASME JEP is a compilation of papers selected from that symposium and is a token of appreciation for Richard Chu’s sustained contributions to electronics cooling and thermal management of electronic systems.

Richard Chu began his professional career at IBM in 1960 as a thermal engineer. During these early years he worked on the development of the IBM System/360. His 1965 invention of a multilevel air-liquid hybrid cooling design was pivotal to IBM’s successful introduction of its System/360 Model 91—the world’s highest performance computer system at the time. The introduction of this hybrid cooling system marked the beginning of the water-cooling era, which lasted through the years of bipolar technology. In 1966 he became a manager with the assignment of establishing and leading a heat transfer technology group to develop new and improved cooling technologies.

Throughout his career, Richard has been a prolific technical innovator, as demonstrated by his impressive record of inventions. During his career he has received 38 IBM invention awards for over 100 patents and has authored over 150 patent disclosure publications. As one of the inventors of the cooling scheme for the IBM Thermal Conduction Module (TCM), he received an IBM Outstanding Innovation Award and a Corporate Award. This high-thermal conduction technology, coupled with his modular cold plate cooling system idea, constituted the primary cooling design for IBM’s large computer systems for more than 15 years following their implementation in 1980. Variations of this water-cooling concept were adapted by each of the major worldwide computer mainframe manufacturers during this time period.

Richard has also received an IBM Outstanding Innovation Award for a heat sink design and water-cooled, cold plate development. The importance of his many contributions to IBM through his creativity, thermal expertise, and technical leadership led to his appointment as an IBM Fellow—the company’s highest technical honor—in 1983. In 1996, he initiated a study for the feasibility of using lower-temperature cooling to enhance CMOS performance. He coined a dual-channel evaporator cold plate, enabling modular refrigeration cooling (MRC) with redundancy and concurrent maintenance. This MRC concept has been used on all of IBM’s CMOS-based high-performance computers since 1997.

In addition to providing ongoing leadership in electronics cooling and thermal management, Richard has been looking ahead to the need for new generations of thermal engineers. He has chaired the National Electronic Manufacturing Initiative (NEMI) technical working group in both 2000 and 2002 to produce a Thermal Management Roadmap Chapter for the NEMI Technology Roadmap. He is also widely known through his active participation in both ASME- and IEEE-sponsored conferences, where he presents papers and often serves as a keynote speaker. He is a coauthor of one of the earliest books on electronic cooling, entitled *Heat Transfer in Microelectronic Equipment*, and in 2002, he coauthored a second book, entitled *Thermal Management of Microelectronic Equipment*, published by ASME Press.

The importance of Richard Chu’s contributions is widely recognized and further attested to by the number of awards and honors he has received, including the ASME Heat Transfer Memorial Award, the InterPACK Achievement Award, and the Semi-Therm Significant Contributor Award. He was the first recipient of the Itherm Memorial Award and is a member and past president of the IBM Academy of Technology. He is a Fellow of ASME and the American Association for the Advancement of Science and is also a member of the National Academy of Engineering. In addition, he has received honorary doctorate degrees from Purdue University and the American University of the Caribbean.

Richard Chu has been an inspiration to the electronics cooling and packaging community through his pioneering research contributions and his invention achievements. This special issue of the ASME JOURNAL OF ELECTRONIC PACKAGING honors Richard’s outstanding leadership, contributions, and service.

Bahgat Sammakia

Professor of Mechanical Engineering,
T. J. Watson School of Engineering,
Director, Integrated Electronics Engineering Center,
Binghamton University

Dereje Agonafer

Professor, Mechanical and Aerospace Engineering Department,
Director, Electronics, MEMS & Nanoelectronics
Systems Packaging Center,
University of Texas at Arlington