

An Eighteenth Successful Year for *JTHT*

SUPPORT from the thermophysics and heat transfer community for the *Journal of Thermophysics and Heat Transfer (JTHT)* continues to be good. The number of submissions is up. Between October 31, 2003 and November 1, 2004, 147 papers were submitted to *JTHT* with 34% originating from technical meetings. During this same time period, over 330 reviews were completed by volunteers to ensure the quality of *JTHT*. The average time between the receipt of a manuscript and the Associate Editor's decision to accept or revise was 3.5 months for the articles appearing in 2004. Fifty percent of the decisions were made in less than 2.5 months. The total number of pages was 574, and all four issues of volume 18 were on schedule.

A Full-Spectrum Publication

It should be re-emphasized that *JTHT* is a full-spectrum publication in the field of thermophysics and heat transfer, a breadth illustrated by the following list of pertinent topics:

Aerothermodynamics

Re-entry
Thermal protection
Low density
Laser interaction
Ablation
Plumes
Computational

Radiative Heat Transfer

Surface interchange
Absorbing-emitting media
Multiple scattering
Nongray analysis
Multidimensional
Coupled with conduction
Coupled with convection

Thermal Control

Heat pipes
Thermal modeling
Electronics cooling
Large space structures
Contamination
Cryogenics
Insulation

Conduction/Phase Change

Contact conductance
Composite materials
Inverse problems
Conjugate problems
Nonlinear problems
Analytical techniques
Melting/solidification

Nonintrusive Diagnostics

IR signatures
Remote sensing
Laser techniques
Particle sizing
Scattering techniques

Convective Heat Transfer

Forced convection
Natural convection
Mixed convection
Internal/external flows
Boiling/condensation

Thermophysical Properties

Thermodynamic
Transport
Optical/radiative

Numerical Heat Transfer

Finite difference
Finite element
Parallel processing

A discipline oriented publication, *JTHT* presents both original contributions of a fundamental nature and application-type papers. Analytical, numerical, and experimental approaches are all encouraged. Papers on the topics of aerothermodynamics, thermal control, and numerical heat transfer are especially encouraged. Although *JTHT* is published by AIAA, papers are not restricted to aerospace topics. Authors from the international thermophysics and heat transfer community are invited to submit papers.

Accuracy and Ethics

The AIAA Publications Committee approved the following: "The AIAA Journals will not accept for publication any paper reporting (1) numerical solutions of an engineering problem that fails to adequately address accuracy of the computed results or

(2) experimental results unless the accuracy of the data is adequately presented." The purpose of this statement is to reiterate the desire to have high quality investigations with properly documented results published in the AIAA journals, and to clarify acceptable standards for presentation of numerical and experimental results. The editors and reviewers will remain the final judges. An ethical standards document was also approved by the Publications Committee and is reproduced in its entirety elsewhere in this issue. Prospective authors and reviewers are encouraged to study it carefully.

Manuscript Submission

Authors are requested to prepare their manuscripts electronically to reduce publication delays. AIAA has developed a web-based manuscript tracking system called WriteTrack. Starting on March 3, 2003, authors have been required to submit their manuscripts to *JTHT* using WriteTrack. PDF format is preferred. Please check AIAA's web site at <http://www.aiaa.org> for more details.

2004 AIAA Thermophysics Award Recipient

Dr. Je-Chin Han, Marcus C. Easterling Chair Professor of



Mechanical Engineering at Texas A&M University, was selected as the 2004 recipient of the AIAA Thermophysics Award. Dr. Han was chosen for his significant contributions to heat transfer augmentation in gas turbine blade cooling, heat transfer in rotating flows, and film cooling in unsteady high turbulent flows. The AIAA Thermophysics Award is presented for an outstanding singular

or sustained technical or scientific contribution by an individual in thermophysics, specifically as related to the properties and mechanisms involved in thermal energy transfer and the study of environmental effects on such properties and mechanisms. This award was presented to him at the AIAA Thermophysics Conference in June 2004 at Portland, Oregon.

2005 Editorial Team

The editorial team includes Associate Editors and members of the Editorial Advisory Board. The Associate Editors are responsible for the technical evaluation of manuscripts, and the burden of maintaining quality rests predominantly with them. Richard Buckius has retired as Associate Editor, after serving six years, and Je-Chin Han has been appointed to Associate Editor. I encourage you to discuss your views of *JTHT* with members of the editorial team.

Appreciation

I would like to express my personal thanks to the authors who have chosen *JTHT* as the vehicle for their research work. I also want to thank the reviewers who have contributed their time to ensure the success of *JTHT*. Their names are listed in this issue. I would like to express my appreciation to Luke McCabe (Managing Editor), Nancy Hulan (Techbooks), and Norma Brennan (Director of Publications) for their help in keeping *JTHT* on schedule.

Alfred L. Crosbie
Editor-in-Chief

Editor-in-Chief



ALFRED L. CROSBIE, Curators' Professor of Mechanical Engineering at the University of Missouri–Rolla, received his B.S. from the University of Oklahoma in 1964, his M.S. in 1966, and his Ph.D. in 1969 from Purdue University, all in mechanical engineering. He joined the faculty of the University of Missouri–Rolla in 1968, where he was promoted to Professor in 1975. He has been an active researcher in the field of radiative heat transfer since 1964. His current research interests include multidimensional radiative heat transfer, multiple scattering, numerical heat transfer, and laser interaction. Dr. Crosbie has served as a member of the AIAA Thermophysics Technical Committee (1976–78), Technical Program Chairman for the AIAA 15th Thermophysics Conference (1980), Editor of two thermophysics volumes in the AIAA Progress in Astronautics and Aeronautics book series (1981), Associate Editor for the *AIAA Journal* (1981–83), and Chairman of the AIAA Thermophysics Technical Committee (1984–86). He is a Fellow of AIAA, AAAS, and ASME, a recipient of the AIAA Thermophysics Award (1987) and the ASME Heat Transfer Memorial Award (1990), and an Associate Editor for the *Journal of Quantitative Spectroscopy and Radiative Transfer* (1979–2005). He was a member of the Editorial Advisory Board for *Heat Transfer–Recent Contents* (1996–2000). Dr. Crosbie is the author or coauthor of over 80 papers in archival journals.

Associate Editors



PING CHENG, Chair Professor of Mechanical and Power Engineering at Shanghai Jiaotong University, received his B.S. in mechanical engineering from Oklahoma State University in 1958, his M.S. in mechanical engineering from Massachusetts Institute of Technology in 1960, and his Ph.D. in aeronautics and astronautics from Stanford University in 1965. He served as Chair of Mechanical Engineering at the University of Hawaii (1987–94) and as Head of Mechanical Engineering at Hong Kong University of Science and Technology (1995–2002). His recent research centers on transport in micro-systems, fuel cells, heat transfer in porous media, and reciprocating compressible flow. Dr. Cheng is a Fellow of ASME and an Associate Fellow of AIAA. He is a recipient of the ASME Heat Transfer Memorial Award (1996) and the AIAA Thermophysics Award (2003). He is an editor of the *International Journal of Heat and Mass Transfer* and *International Communications in Heat and Mass Transfer*, and is a member of editorial boards of *Numerical Heat Transfer*, *Experimental Heat Transfer*, *Journal of Porous Media*, *Acta Mechanica*, *Revue Generale de Thermique*, and *International Green Energy*. He is author or coauthor of over 200 publications.



RONALD L. DOUGHERTY, Professor and Chair of Mechanical Engineering at the University of Kansas (KU), received his B.S. in 1972, M.S. in 1974, and Ph.D. in 1978 from the University of Missouri–Rolla, all in mechanical engineering. Before joining KU in 1999, he held positions at Pratt-Whitney Aircraft (1978–83), Terra Tek, Inc. (1983–85), and Oklahoma State University (1985–99). His recent research centers on radiative transfer in participating media, dynamic light scattering/photon spectroscopy, and particle characterization by nonintrusive laser diagnostics. Dr. Dougherty was a member of the AIAA Thermophysics Technical Committee (1986–89), Thermophysics Technical Program Chair at the AIAA 30th Aerospace Sciences Meeting (1992), and Chair of the Oklahoma Section of AIAA (1995–96). He has been a member of the American Society of Mechanical Engineers Heat Transfer Division's committee on Theory and Fundamental Research since 1993. He has chaired 10 thermophysics sessions at AIAA meetings. He is the author or coauthor of over 40 publications.



JE-CHIN HAN, Marcus C. Easterling Chair Professor of Mechanical Engineering at Texas A&M University, received his B.S. from National Taiwan University in 1970, his M.S. from Lehigh University in 1973, and his Sc.D. from Massachusetts Institute of Technology in 1976, all in mechanical engineering. After working at Ex-Cell-O Corporation (1976–80) as a R&D Engineer, he joined the faculty of Texas A&M University in 1980, where he was promoted to Professor in 1989. His research centers on augmentation in gas turbine blade cooling, heat transfer in rotating flows, and film cooling in unsteady high turbulent flows. He was a member of the AIAA Thermophysics Technical Committee (1997–2000) and was Thermophysics Program Chair at the AIAA 38th Aerospace Sciences Meeting (2000). He is the recipient of the ASME Heat Transfer Memorial Award (2002) and the AIAA Thermophysics Award (2004). Dr. Han is a fellow of ASME and an Associate Fellow of AIAA. He was an Associate Technical Editor of ASME Journal of Heat transfer (1997–2000). He is author or coauthor of over 130 papers in archival journals and a book on gas turbine heat transfer.



H. FREDERICK NELSON, Professor of Aerospace Engineering at the University of Missouri–Rolla, received his B.S. in Aerospace Engineering from Iowa State University in 1961, and his M.S. and Ph.D. in Aeronautical Engineering from Purdue University in 1964 and 1968, respectively. He joined the faculty of the University of Missouri–Rolla in 1968, where he was promoted to Professor in 1978. He has taken sabbatical leaves at the Jet Propulsion Laboratory (1974–75), Rocket Propulsion Laboratory at Edwards (1981–82), and NASA Ames Research Center (1988–89). His research interests include aerothermodynamics of planetary entry, nonequilibrium ionization and chemistry in gas dynamics, shock wave structure, and plume radiation. Dr. Nelson was a member of the AIAA Thermophysics Technical Committee (1979–81, 89), General Program Chairman of the 19th AIAA Thermophysics Conference (1984), Chairman of the AIAA Thermophysics Technical Committee (1990–92), and Editor of a thermophysics volume in the AIAA Progress in Astronautics and Aeronautics book series (1985). He is an Associate Fellow of AIAA and a recipient of the AIAA National Faculty Advisor Award (1991). Dr. Nelson is author or coauthor of over 70 papers in archival journals.



GEORGE P. "BUD" PETERSON, Provost at Rensselaer Polytechnic Institute, received his B.S. in mechanical engineering in 1975, his B.S. in mathematics in 1977, and his M.S. in engineering in 1980, all from Kansas State University, and his Ph.D. in mechanical engineering from Texas A&M University in 1981. He joined the faculty of Texas A&M University in 1981, where he was promoted to Professor in 1990, Tenneco Professor in 1991, Head of Mechanical Engineering in 1993, Associate Vice-Chancellor and Executive Associate Dean of Engineering in 1996. He served as Program Director of Thermal Transport and Thermal Processing at the National Science Foundation (1993–94). His research interests include phase change heat transfer, thermal control, conduction, and thermal contact resistance. He was a member of the AIAA Thermophysics Technical Committee (1986–89) and AIAA representative to the National Heat Transfer Conference (1990–93). He was an Associate Editor of the *Journal of Energy Resources Technology* (1986–92) and Editor of *Heat Transfer—Recent Contents* (1992–95). He is an Editor for *Experimental and Fluid Sciences* and *Microscale Thermophysical Engineering* and an Associate Editor for the *Journal of Heat Transfer* and the *Journal of Heat and Fluid Flow*. Dr. Peterson is a Fellow of ASME and AIAA and a recipient of the AIAA Award for Best Technical Paper in Thermophysics (1991) and of the AIAA Thermophysics Award (1996). He is the author or coauthor of over 130 papers in archival journals, seven book chapters, and a textbook on heat pipes.



ALLIE M. SMITH, Emeritus Dean of Engineering and Professor of Mechanical Engineering at the University of Mississippi, received his B.S. in mechanical engineering from North Carolina State University in 1956 and his M.S. in 1961 and his Ph.D. in 1966 from North Carolina State University in mechanical and aerospace engineering. Before joining the University of Mississippi in 1979, he worked for ARO for 14 years as a thermal physics supervisor and as a research manager. His research work has been in the area of radiative heat transfer, particularly the experimental and theoretical understanding of cryodeposits. Dr. Smith has been active in the AIAA thermophysics community: member of the AIAA Thermophysics Technical Committee (1973–75, 1985–88), Chairman of the AIAA Thermophysics Technical Committee (1976–77), and General Chairman of the 10th AIAA Thermophysics Conference (1975). He served as an Associate Editor of the *AIAA Journal* (1975–77), Editor for two thermophysics volumes in the AIAA Progress in Astronautics and Aeronautics book series (1976, 1977), General Chairman of the 17th Aerospace Sciences Meeting (1979), and Chairman of the AIAA Terrestrial Energy Systems Committee (1981–82). Dr. Smith is a Fellow of AIAA and ASME and recipient of the AIAA Thermophysics Award (1978) and the AIAA Hermann Oberth Award (1985). He is the author or coauthor of over 75 publications.

Editorial Advisory Board



TOM J. LOVE, George Lynn Cross Professor Emeritus of Aerospace, Mechanical, and Nuclear Engineering and Halliburton Professor of Engineering at the University of Oklahoma, received his B.S. from the University of Oklahoma in 1948, his M.S. from the University of Kansas in 1956, and his Ph.D. from Purdue University in 1963, all in mechanical engineering. In 1956 he joined the faculty of the University of Oklahoma, where he was promoted to Professor (1965) and served as Director of the School of Aerospace, Mechanical, and Nuclear Engineering (1963–72). He was a member of the AIAA Thermophysics Technical Committee (1970–72), an Associate Editor for the *AIAA Journal* (1972–75), and an Associate Editor for *ASME Journal of Bioengineering* (1976–79). He is a Fellow of AIAA and ASME. Dr. Love is a recipient of the AIAA Thermophysics Award (1984) and of the ASME Memorial Heat Transfer Award (1989).



JAMES N. MOSS, Senior Research Engineer for Aerothermodynamics at the NASA Langley Research Center, received his B.S. in engineering science from the Tennessee Polytechnic Institute in 1962, his M.S. in aerospace engineering from the University of Virginia in 1968, and his Ph.D. in aerospace engineering from Virginia Polytechnic Institute and State University in 1972. He also received an M.S. in engineering administration in 1988 from George Washington University. Dr. Moss joined NASA in 1962, where his early research assignments dealt with ablating systems. His current research concerns transitional and rarefied flows. Dr. Moss has been active in the AIAA thermophysics community: member of the AIAA Thermophysics Technical Committee (1978–80), Technical Program Chairman of the 16th AIAA Thermophysics Conference (1981), General Program Chairman of the 20th AIAA Thermophysics Conference (1985), Co-Editor of a thermophysics volume in the AIAA Progress in Astronautics and Aeronautics book series (1986), Chairman of the AIAA Thermophysics Technical Committee (1986–88), and Associate Editor of the *Journal of Thermophysics and Heat Transfer* (1986–89). He is a Fellow of AIAA and a member of the International Advisory Committee on Rarefied Gas Dynamics. Dr. Moss is a recipient of the AIAA Thermophysics Award (1989) and the NASA Exceptional Engineering Achievement Medal (1990).



ROBERT SIEGEL, Heat Transfer Consultant, received his B.S. in 1950 and M.S. in 1951 from the Case Institute of Technology and his Sc.D. from the Massachusetts Institute of Technology in 1953, all in mechanical engineering. He worked at NASA John H. Glenn Research Center at Lewis Field from 1955 to 1999 and became a Senior Research Scientist. Before joining NASA, he worked for General Electric as a heat transfer engineer and analyst. He has been an active researcher in heat transfer since 1950. The majority of his research is in radiative heat transfer, reduced-gravity boiling, transient convection, and solidification. He invented the first drop tower. He served as an Associate Technical Editor for the *Journal of Heat Transfer* (1973–83) and an Associate Editor of the *Journal of Thermophysics and Heat Transfer* (1986–98). Dr. Siegel is a Fellow of AIAA and ASME and a member of the Honorary Advisory Boards of the *International Journal of Heat and Mass Transfer* and *International Communications in Heat and Mass Transfer*. He is the recipient of the ASME Heat Transfer Division's Memorial Award (1970), the NASA Exceptional Scientific Achievement Award (1986), a Space Act Award (1993), the AIAA Thermophysics Award (1993), and the ASME/AIChE Max Jakob Memorial Award (1996).



RAYMOND VISKANTA, W.F.M. Goss Distinguished Professor Emeritus of Engineering at Purdue University, received his B.S. from the University of Illinois in 1955, and his M.S. in 1956 and Ph.D. in 1960 from Purdue University, all in mechanical engineering. After a brief period with Argonne National Laboratory, he joined the faculty of Purdue University, where he was promoted to Professor in 1966. He was a member of the AIAA Thermophysics Technical Committee (1972–75), General Chairman of the 2nd AIAA/ASME Joint Thermophysics and Heat Transfer Conference (1978), and Editor of two volumes in the AIAA Progress in Astronautics and Aeronautics book series (1979). He is a recipient of the ASME Heat Transfer Division's Memorial Award (1976), the AIAA Thermophysics Award (1979), the ASME Senior Research Award (1984), the ASME/AIChE Max Jakob Memorial Award (1986), the ASME Melville Medal (1988), and the 1991 Nusselt-Reynolds Prize of the Assembly of World Conferences on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics. Dr. Viskanta is a Fellow of ASME and AIAA, a member of the National Academy of Engineering, a foreign member of the Academy of Engineering Sciences of the Russian Federation, and a Dr.-Ing. E.h. (Honorary Doctor of Engineering Degree) from Technical University of Munich. He was an Associate Editor for the *Journal of Quantitative Spectroscopy and Radiative Transfer* (1969–72), an Associate Technical Editor for the *Journal of Heat Transfer* (1981–87) and *Experimental Heat Transfer* (1987–90), and the Technical Editor of the *ASME Journal of Heat Transfer* (1990–95). He is a member of the Editorial Advisory Boards of the *International Journal of Heat and Mass Transfer*, *International Journal of Heat and Fluid Flow*, *AIAA Journal*, and *Numerical Heat Transfer* and was Chair of the Committee on Microgravity Research and member of the Space Studies Board of the National Research Council (1997–2000).



M. MICHAEL YOVANOVICH, Distinguished Professor Emeritus of Mechanical Engineering at the University of Waterloo, Ontario, Canada, received his B.S. from Queen's University in 1957, his M.S. from the State University of New York at Buffalo in 1963, and his M.E. and Sc.D. from the Massachusetts Institute of Technology in 1965 and 1967, respectively. After a brief period with the University of Poitiers in France, he joined the faculty of the University of Waterloo, where he was promoted to Professor in 1972. He was a member of the AIAA Thermophysics Technical Committee (1971–74, 85–88, 91–94), General Chairman of the first AIAA/ASME Joint Thermophysics and Heat Transfer Conference (1974), and Editor of a thermophysics volume in the AIAA Progress in Astronautics and Aeronautics book series (1975). He is a recipient of the AIAA Thermophysics Award (1984) and the AIAA Award for Best Technical Paper in Thermophysics (1983 and 1994). Dr. Yovanovich is a Fellow of AAAS, AIAA, and ASME. He was an Associate Technical Editor of the *ASME Journal of Heat Transfer* (1984–86) and Associate Senior Editor of the *ASME Journal of Electronic Packaging* (1988–93). He was a member of the Editorial Advisory Boards of the *Transactions of the Canadian Society of Mechanical Engineers* and the *International Journal of Heat and Fluid Flow*.