

In Memoriam: Professor Ephraim Maurice Sparrow



Ephraim Maurice Sparrow

On Thursday Aug. 1, 2019, we were deeply saddened to hear that Professor Ephraim M. Sparrow passed away at the age of 91 years. Professor Ephraim M. Sparrow was born on May 27, 1928, and through his extensive professional career he became one of the best-known and respected researchers in the field of heat transfer. He received his B.Sc. and M.S. in 1948 and 1949, respectively, from the Massachusetts Institute of Technology (MIT). Then, he moved to Harvard University to receive his M.A. and Ph.D. in 1950 and 1952, respectively. His Ph.D. thesis is titled “Free Convection With Variable Properties

and Variable Wall Temperature” under the supervision of Professor Howard Wilson Emmons.

After finishing his Ph.D. in 1952, Professor Ephraim M. Sparrow joined Raytheon, where he worked on different heat transfer problems such as radar, electronics cooling, and the first microwave oven. Later, he joined the National Advisory Committee for Aeronautics (NACA) (now National Aeronautics and Space Administration (NASA)), Lewis Flight Propulsion Laboratory, Cleveland, OH where he worked on fluid mechanics and heat transfer. He had many publications from his work in NASA such as two papers [1,2] in the first issue of ASME *Journal of Heat Transfer* (JHT), which was published in February 1959 with 15 papers, two papers [3,4] in the second issue of JHT (May 1959), one paper [5] in the third issue of JHT (August 1959), and two papers [6,7] in the fourth issue of JHT (November 1959).

In 1959, he started his career at the Thermodynamics and Heat Transfer Laboratory (THTL), Department of Mechanical Engineering, University of Minnesota, Minneapolis, MN. THTL was established by Professor Ernst R. G. Eckert in 1950. Within the period 1968–1980, Professor Ephraim M. Sparrow served as the fluid mechanics chairman program. Within the period 1986–1988, Professor Ephraim M. Sparrow worked at the National Science Foundation (NSF), first as Program Manager of Heat Transfer and posteriorly as the CBET division director in the engineering directorate. At NSF, he stressed the need to focus on practical problems and important fundamental issues. At the time of his death, he was both the longest serving faculty member and the oldest in the Department of Mechanical Engineering, University of Minnesota, Minneapolis, MN.

During his academic life, Professor Sparrow supervised more than 250 Master’s degree students and more than 100 doctoral degree students. Many of his previous Ph.D. graduate students became professors at well-known universities across the globe. Professor Sparrow has published many papers, reports, and books on fluid mechanics, and heat transfer such as Refs. [8] and [9]. His paper in ASME *Journal of Heat Transfer* (JHT), which was published in May 1977 about “Fully Developed Flow and Heat Transfer in Ducts Having Streamwise-Periodic Variations of Cross-Sectional Area” [10] was his most cited paper. He pioneered research in many important areas of heat transfer and his extensive contributions provided tremendous incentive to researchers and engineers around the world.

In May 1988, Eph’s 60th Birthday was celebrated with an article published in the *International Journal of Heat and Mass Transfer* [11]. Following his 60th birthday in 1988 until his death in 2019, Eph did not show any evidence of slowing down and was,

in his typical manner, very active in pursuing his research interests. Professor Ephraim M. Sparrow was very active until the last year of his life. For example, he had these publications in 2019 [12–18].

During his academic career, following Professor W. H. Giedt in 1972, Professor Ephraim M. Sparrow served as the Editor of the ASME *Journal of Heat Transfer* until 1980 when this position was succeeded by Professor K. T. Yang.

In 1979, he cofounded with Professor W. J. Minkowycz the journal titled *Numerical Heat Transfer* in order to serve as a forum for the dissemination of ideas and research in the field of numerical heat transfer and computational fluid dynamics (CFD). He was the guest editor on many occasions. For example, he was the guest editor of a Biomedical-Related Special Issue in the *International Journal of Heat and Mass Transfer* with Professor John P. Abraham, University of St. Thomas, in November 2008 [19]. He was co-author with Professors J. P. Abraham, and R. D. Lovik in a paper about “Unsteady, three-dimensional fluid mechanic analysis of blood flow in plaque-narrowed and plaque-free arteries” in the Biomedical-Related Special Issue [20]. Also, volume 50, *Advances in Heat Transfer* was edited by Ephraim M. Sparrow, John P. Abraham, and John M. Gorman.¹ This volume had six chapters. Professor Ephraim M. Sparrow was the co-author of the first chapter about “Enhancement of Jet Impingement Heat Transfer by Means of Jet Axis Switching” [21].

Furthermore, the contributions of Professor Ephraim M. Sparrow have spanned many areas and have been recognized by numerous honors and awards. They include: Max Jakob Memorial Award in 1976, Member of the National Academy of Engineering in 1986, Monie A. Ferst Award in 1993, Fellow of the American Society of Mechanical Engineers (ASME), and the ASME Ralph Coates Roe Medal.

In July 2020, there will be a Memorial Track of Professor Ephraim Sparrow for celebrating his life and research contributions. This special symposium will be organized by the Heat Transfer Division (HTD) in his memory. Contributions for this symposium are solicited from all pertinent technical topic areas involving personal recollections from the three programs: ICNMM 2020, SHTC 2020, and FEDSM 2020 at Rosen Shingle Creek, Orlando, FL, July 12–15, 2020.²

It is hard to find proper words to express our feelings at this sad moment, but without any doubt the professional community will remember Professor Ephraim M. Sparrow as an excellent and prolific scientist, teacher, mentor and above all a pleasant and honest person, and a highly respectful colleague with an outstanding character and ethics. We will all miss him dearly.

Mohamed M. Awad³

Mem. ASME

**Mechanical Power Engineering Department,
Faculty of Engineering,
Mansoura University,
Mansoura 35516, Egypt
e-mail: m_m_awad@mans.edu.eg**

Adrian Bejan

**Department of Mechanical Engineering and
Materials Science,
Duke University,
Durham, NC 27708-0300
e-mail: abejan@duke.edu**

¹Contributed by the Heat Transfer Division of ASME for publication in the JOURNAL OF HEAT TRANSFER. Manuscript received January 23, 2020; final manuscript received February 7, 2020; published online February 27, 2020. Editor: Portonovo S. Ayyaswamy.

¹<https://www.sciencedirect.com/bookseries/advances-in-heat-transfer/vol/50/suppl/C>

²https://event.asme.org/FEDSM/Topics?utm_source=CF&utm_medium=email&utm_campaign=10232019_CF_FEDSM&utm_content=SEG0009014&asme promo=MERO017751

³Corresponding author.

Vijay K. Dhir
Mechanical and Aerospace Engineering Department,
Henry Samueli School of Engineering and Applied Science,
University of California,
Los Angeles, CA 90095
e-mail: vdhir@seas.ucla.edu

Richard J. Goldstein
Department of Mechanical Engineering,
University of Minnesota,
Minneapolis, MN 55455
e-mail: rjgme@umn.edu

Abdolhossein Haji-Sheikh
Department of Mechanical and Aerospace Engineering,
University of Texas at Arlington,
Arlington, TX 76019
e-mail: haji@uta.edu

John R. Howell
Department of Mechanical Engineering,
The University of Texas at Austin,
Austin, TX 78712
e-mail: jhowell@mail.utexas.edu

Yogesh Jaluria
Mechanical Engineering Department,
Rutgers University,
Piscataway, NJ 08854
e-mail: jaluria@jove.rutgers.edu

John R. Lloyd
Department of Mechanical Engineering,
College of Engineering,
Michigan State University,
East Lansing, MI 48824
e-mail: lloyd@msu.edu

Suhas V. Patankar
Department of Mechanical Engineering,
University of Minnesota,
Minneapolis, MN 55455
e-mail: patan001@umn.edu

Terrence W. Simon
Department of Mechanical Engineering,
University of Minnesota,
Minneapolis, MN 55455
e-mail: simon002@umn.edu

Kumar K. Tamma
Department of Mechanical Engineering,
University of Minnesota,
Minneapolis, MN 55455
e-mail: ktamma@umn.edu

Raymond Viskanta
Heat Transfer Laboratory,
School of Mechanical Engineering,
Purdue University,
West Lafayette, IN 47907
e-mail: viskanta@ecn.purdue.edu

Portonovo Ayyaswamy
Editor, ASME Journal of Heat Transfer,
Department of Mechanical Engineering
and Applied Mechanics,
University of Pennsylvania,
Philadelphia, PA 19104
e-mail: ayya@seas.upenn.edu

References

- [1] Sparrow, E. M., and Gregg, J. L., 1959, "A Boundary-Layer Treatment of Laminar-Film Condensation," *ASME J. Heat Transfer*, **81**(1), pp. 13–18.
- [2] Siegel, R., and Sparrow, E. M., 1959, "Transient Heat Transfer for Laminar Forced Convection in the Thermal Entrance Region of Flat Ducts," *ASME J. Heat Transfer*, **81**(1), pp. 29–36.
- [3] Sparrow, E. M., and Gregg, J. L., 1959, "A Theory of Rotating Condensation," *ASME J. Heat Transfer*, **81**(2), pp. 113–119.
- [4] Sparrow, E. M., and Siegel, R., 1959, "A Variational Method for Fully Developed Laminar Heat Transfer in Ducts," *ASME J. Heat Transfer*, **81**(2), pp. 157–164.
- [5] Sparrow, E. M., and Gregg, J. L., 1959, "Heat Transfer From a Rotating Disk to Fluids of Any Prandtl Number," *ASME J. Heat Transfer*, **81**(3), pp. 249–251.
- [6] Siegel, R., and Sparrow, E. M., 1959, "Turbulent Flow in a Circular Tube With Arbitrary Internal Heat Sources and Wall Heat Transfer," *ASME J. Heat Transfer*, **81**(4), pp. 280–287.
- [7] Sparrow, E. M., and Gregg, J. L., 1959, "Laminar Condensation Heat Transfer on a Horizontal Cylinder," *ASME J. Heat Transfer*, **81**(4), pp. 291–295.
- [8] Sparrow, E. M., and Cess, R. D., 1978, *Radiation Heat Transfer*, CRC Press, Boca Raton, FL.
- [9] Minkowycz, W. J., Sparrow, E. M., and Murthy, J. Y., eds., 2006, *Handbook of Numerical Heat Transfer*, 2nd ed., Wiley, Hoboken, NJ.
- [10] Patankar, S. V., Liu, C. H., and Sparrow, E. M., 1977, "Fully Developed Flow and Heat Transfer in Ducts Having Streamwise-Periodic Variations of Cross-Sectional Area," *ASME J. Heat Transfer*, **77**(2), pp. 180–186.
- [11] Minkowycz, W. J., Torrance, K. E., Lloyd, J. R., Hartnett, J. P., Chen, T. S., and Haji-Sheikh, A., 1988, "Professor Ephraim M. Sparrow on His 60th Birthday," *Int. J. Heat Mass Transfer*, **31**(5), pp. 905–906.
- [12] Smith, C., Gorman, J., and Sparrow, E., 2019, "Dual Scales of Permeability in Regularly Structured Packed Beds of Spheres," *J. Porous Media*, **22**(10), pp. 1243–1258.
- [13] Gorman, J. M., Sparrow, E. M., Katz, S. D. M., and Minkowycz, W. J., 2019, "Convective Heat Transfer Coefficients on All External Surfaces of a Generic Residential Building in Crossflow," *Numer. Heat Transfer; Part A: Appl.*, **75**(2), pp. 71–90.
- [14] Abraham, J. P., Stark, J., Gorman, J., Sparrow, E., and Minkowycz, W. J., 2019, "Tissue Burns Due to Contact Between a Skin Surface and Highly Conducting Metallic Media in the Presence of Inter-Tissue Boiling," *Burns*, **45**(2), pp. 369–378.
- [15] Gorman, J. M., Sparrow, E. M., and Ahn, J., 2019, "In-Line Tube-Bank Heat Exchangers: Arrays With Various Numbers of Thermally Participating Tubes," *Int. J. Heat Mass Transfer*, **132**, pp. 837–847.
- [16] Abraham, J. P., Sparrow, E. M., Gorman, J. M., Zhao, Y., and Minkowycz, W. J., 2019, "Application of an Intermittency Model for Laminar, Transitional, and Turbulent Internal Flows," *ASME J. Fluids Eng.*, **141**(7), p. 071204.
- [17] Gorman, J. M., Zheng, A., and Sparrow, E. M., 2019, "Bounding Wall Effects on Fluid Flow and Pressure Drop Through Packed Beds of Spheres," *Chem. Eng. J.*, **373**, pp. 519–530.
- [18] Olsen, L. E., Abraham, J. P., Cheng, L., Gorman, J. M., and Sparrow, E. M., 2019, "Summary of Forced-Convection Fluid Flow and Heat Transfer for Square Cylinders of Different Aspect Ratios Ranging From the Cube to a Two-Dimensional Cylinder," *Adv. Heat Transfer*, **51**, pp. 351–457.
- [19] Minkowycz, W. J., 2008, "Biomedical-Related Special Issue," *Int. J. Heat Mass Transfer*, **51**(23–24), p. 5477.
- [20] Abraham, J. P., Sparrow, E. M., and Lovik, R. D., 2008, "Unsteady, Three-Dimensional Fluid Mechanic Analysis of Blood Flow in Plaque-Narrowed and Plaque-Freed Arteries," *Int. J. Heat Mass Transfer*, **51**(23–24), pp. 5633–5641.
- [21] Gorman, J. M., Sparrow, E. M., Ghosh, A., and Abraham, J. P., 2018, "Enhancement of jet impingement heat transfer by Means of Jet Axis Switching," *Adv. Heat Transfer*, **50**, pp. 1–41.