

# References

1. Kornhauser, A.A., "The Use of an Ejector as a Refrigerant Expander," *Proceedings of the 1990 USNC/IIR-Purdue Refrigeration Conference*, Purdue University, 1990.
2. Menegay, P., "Experimental Investigation of an Ejector as a Refrigerant Expansion Engine," M.S. Thesis, Virginia Polytechnic Institute and State University, 1991.
3. Menegay, P. and Kornhauser, A.A., "Improvements to the Ejector Expansion Refrigeration Cycle," *Proceedings of the 31st Intersociety Energy Conversion Engineering Conference*, Washington, D.C., 1996.
4. Gay, N.H., "Refrigerating System," U.S. Patent No. 1,836,318, 1931.
5. Kemper, G.A., Harper, G.F., and Brown, G.A., "Multiple Phase Ejector Refrigeration System," U.S. Patent No. 3,277,660, assigned to Joseph Kaye & Co., Cambridge, MA, 1966.
6. Newton, A.B., "Capacity Control for Multiple-Phase Ejector Refrigeration Systems," U.S. Patent No. 3,670,519, assigned to Borg-Warner Corporation, Chicago, IL, 1972.
7. Newton, A.B., "Controls for Multiple-Phase Ejector Refrigeration Systems," U.S. Patent No. 3,701,264, assigned to Borg-Warner Corporation, Chicago, IL, 1972.
8. Henry, R.E., and Fauske, H.K., "The Two-Phase Critical Flow of One-Component Mixtures in Nozzles, Orifices, and Short Tubes," *ASME Journal of Heat Transfer*, May 1971, pp. 179-187.
9. Kornhauser, A.A. and Menegay, P., "Method of Reducing Flow Metastability in an Ejector Nozzle," U.S. Patent No. 5,343,711, assigned to Virginia Tech Intellectual Properties, Inc., Blacksburg, VA, 1994.
10. Alexandrian, M., "Measurement of the Efficiency of a Flashing Flow Nozzle," M.S. Thesis, Virginia Polytechnic Institute and State University, 1994.
11. Bunch, T.K., "Performance Measurements of a Flashing Flow Nozzle," M.S. Thesis, Virginia Polytechnic Institute and State University, 1996.

12. Kornhauser, A.A., Bunch, T.K., and Alexandrian, M.P., "Efficiency of a Flashing Flow Nozzle," *Proceedings of the 31st Intersociety Energy Conversion Engineering Conference*, 1996.
13. Harrell, G.S. and Kornhauser, A.A., "Performance Tests of a Two-Phase Ejector," *Proceedings of the 30th Intersociety Energy Conversion Engineering Conference*, Orlando, FL, 1995.
14. Starkman, E.S., Schrock, V.E., Neusen, K.F., and Maneely, D.J., "Expansion of a Very Low Quality Two-Phase Fluid Through a Convergent-Divergent Nozzle," *ASME Journal of Basic Engineering*, Vol. 86, June 1964, pp. 247-256.
15. Saha, P., "A Review of Two-Phase Steam-Water Critical Flow Models With Emphasis on Thermal Nonequilibrium," NUREG/CR-0417, BNL-NUREG-50907, Brookhaven National Laboratory, Upton, NY, 1978.
16. Wallis, G.B., "Critical Two-Phase Flow," *International Journal of Multiphase Flow*, Vol. 6, pp. 97-112, 1980.
17. Ardron, K.H. and Furness, R.A., "A Study of the Critical Flow Models Used in Reactor Blowdown Analysis," *Nuclear Engineering and Design*, 39, pp. 257-266, 1976.
18. Richter, H.J., "Separated Two-Phase Flow Model: Application to Critical Two-Phase Flow," *International Journal of Multiphase Flow*, Vol. 9, No. 5, pp. 511-530, 1983.
19. Dobran, F., "Nonequilibrium Modeling of Two-Phase Critical Flows in Tubes," *ASME Journal of Heat Transfer*, Vol. 109, pp. 731-738, Aug., 1987.
20. Ardron, K.H., "A Two-Fluid Model for Critical Vapour-Liquid Flow," *International Journal of Multiphase Flow*, Vol. 4, pp. 323-337, 1978.
21. Schwellnus, C.F. and Shoukri, M., "A Two-Fluid Model for Non-Equilibrium Two-Phase Critical Discharge," *The Canadian Journal of Chemical Engineering*, Vol. 69, Feb., 1991.
22. Wallis, G.B., One-Dimensional Two-Phase Flow, McGraw-Hill, New York, 1969.

23. Harrell, G.S., "Testing and Modeling of a Two-Phase Ejector," Ph.D. Dissertation, Virginia Polytechnic Institute and State University, 1997.
24. Ishii, M. and Mishima, K., "Two-Fluid Model and Hydrodynamic Constitutive Relations," *Nuclear Engineering and Design*, 82, pp. 107-126, 1984.
25. Ishii, M., *Thermo-Fluid Dynamic Theory of Two-Phase Flow*, Eyrolles, Paris, 1975.
26. Lahey, R.T. and Drew, D.A., "On the Development of Multidimensional Two-Fluid Models for Vapor/Liquid Two-Phase Flow," *Chemical Engineering Communications*, Vol. 118, pp. 125-139, 1992.
27. Dobran, F., "Theory of Multiphase Mixtures," *International Journal of Multiphase Flow*, Vol. 11, No. 1, pp. 1-30, 1985.
28. Dobran, F., "Modeling of Structured Multiphase Mixtures," *International Journal of Engineering Science*, Vol. 30, No. 10, pp. 1497-1505, 1992.
29. Sukumar, R., CFD Research Corporation, private communication, Aug. 16, 1994.
30. Dombrowski, N., Foumeny, E.A., and Riza, A., "Know the CFD Codes," *Chemical Engineering Progress*, Sept., 1993.
31. Foumeny, E.A. and Benyahia, F., "Can CFD Improve the Handling of Air, Gas and Gas-Liquid Mixtures?," *Chemical Engineering Progress*, Feb., 1993.
32. Arnold, G.S., Drew, D.A., and Lahey, R.T., "An Assessment of Multiphase Flow Models Using the Second Law of Thermodynamics," *International Journal of Multiphase Flow*, Vol. 16, No. 3, pp. 481-494, 1990.
33. Dobran, F., "Liquid and Gas-Phase Distributions in a Jet With Phase Change," *ASME Journal of Heat Transfer*, Vol. 110, pp. 955-960, Nov., 1988.
34. Spalding, D.B., *Numerical Computation of Multiphase Flows*, Von Karman Institute for Fluid Dynamics, Lecture Series, 1981-2.
35. Crowe, C.T., "Two-Fluid vs. Trajectory Model: Range of Applicability," *Gas-Solid Flows*, ASME FED-Vol. 35, pp. 91-96.
36. White, F.W., *Fluid Mechanics*, 2nd Ed., McGraw-Hill, New York, 1986.
37. Bejan, A., *Convection Heat Transfer*, Wiley-Interscience, New York, 1984.

38. Solbrig, C.W., et al., "Heat Transfer and Friction Correlations Required to Describe Steam-Water Behavior in Nuclear Safety Studies," *AIChE Symposium Series*, Vol. 74, pp. 100-128, 1978.
39. Baker, O., "Simultaneous Flow of Oil and Gas," *Oil and Gas Journal*, 53, 185, July, 1954.
40. Weisman, J. et al., "Effects of Fluid Properties and Pipe Diameter on Two-Phase Flow Patterns in Horizontal Lines," *International Journal of Multiphase Flow*, Vol. 5, pp. 437-462, 1979.
41. Hinze, J.O., "Fundamentals of the Hydrodynamic Mechanism of Splitting in Dispersion Processes," *AIChE Journal*, Vol. 1, 1955.
42. Kolmogoroff, A.N., *Doklady Akad. Nauk.*, SSSR, Vol. 66, 825, 1949.
43. Hesketh, R.P., Fraser Russell, T.W., and Etchells, A.W., "Bubble Size in Horizontal Pipelines," *AIChE Journal*, Vol. 33, No. 4, 1987.
44. White, F.M., *Viscous Fluid Flow*, 2nd ed., McGraw-Hill, New York, 1991.
45. Razinsky, E., and Brighton, J.A., "Confined Jet Mixing for Nonseparating Conditions," *Journal of Basic Engineering*, Sept. 1971, pp. 333-349.
46. NIST, "NIST Thermodynamic Properties of Refrigerants and Refrigerant Mixtures Database, Version 1," U.S. Dept. of Commerce, 1989.
47. Kornhauser, A.A., Va. Tech - Mechanical Engineering Dept., private communication, 1995.
48. Patankar, S.V., *Numerical Heat Transfer and Fluid Flow*, Hemisphere Publishing Corp., New York, 1980.
49. Kornhauser, A.A., "Flow Regime Transition Shocks in Flashing Flow Nozzles," Va. Tech - Mechanical Engineering Dept. Seminar, March 25, 1996.
50. Hill, P.G., "Turbulent Jets in Ducted Streams," *Journal of Fluid Mechanics*, Vol. 22, part 1, pp. 161-186, 1965.
51. Schetz, J.A., "Injection and Mixing in Turbulent Flow," *Progress in Astronautics and Aeronautics*, Vol. 68, 1980.

52. Anderson, D.A., Tannehill, J.C., and Pletcher, R.H., *Computational Fluid Mechanics and Heat Transfer*, Hemisphere Publishing Corp., New York, 1984.

# Vita

The author was born on August 1, 1966 in Cairo, Egypt. He grew up overseas, mainly in Latin America, since his father was employed by an international development organization (CARE). In 1984 he enrolled at Virginia Tech, and graduated in 1988 with a B.S. in Mechanical Engineering. From there he moved on to work for DuPont at their DeLisle, MS titanium dioxide plant. As a practicing engineer he realized how little he really knew and decided to return to school. In January, 1990 he re-enrolled at Virginia Tech where he received an M.S. in Mechanical Engineering the following year. From there he continued his graduate studies and pursued the work described in this document. His plans for the immediate future are to return to DuPont at their nylon fibers R&D facility in Chattanooga, TN.