Ezra Elias - Curriculum Vitae

Academic Degrees:

1968: B.Sc., Chemical Engineering, Technion, Haifa, Israel.
1971: M.Sc., Nuclear Engineering, Technion, Haifa, Israel.
1975: Ph.D., Nuclear Engineering, Technion, Haifa, Israel.

Present Academic Position:

Emeritus Professor - Faculty of Mechanical Engineering Technion IIT, Haifa. Israel,

Academic Appointments:

1968-1975: Teaching and Research Assistant, Department of Nuclear Engineering, Technion.
1975-1978: Research Associate, UC Berkeley, California.
1978-1984: Senior Lecturer, Department of Nuclear Engineering, Technion.
1984-1989: Associate Professor, Department of Nuclear Engineering, Technion.
1988-1989: Chairman of the Department of Nuclear Engineering, Technion.
1997, spring: Visiting Scholar, UC Berkeley, California.
1998-2007 : Member Appointment Committee – Holon, Institute of Technology, Israel
2000-2001: Visiting Professor, National University (NUS), Singapore.
2008-2009: Visiting Professor, Nanyang Technological University (NTU), Singapore.
2010, summer: Visiting Professor Xidian University, China.
2011-2012: Visiting Professor, Nanyang Technological University (NTU), Singapore.

Professional Experience:

1979, summer: Visiting Scientist, Brookhaven National Laboratories, New York.

1981-1983: Associate Scientist, S. Levy Inc., San Jose, California.

1996, winter: Associate Scientist, FZK research Center, Karlsruhe, Germany.

1985 - 1995 : Senior Consultant, Rapiscan Systems, OSIS Inc. Santa Clara, California.

Research Interest:

Fluid and Thermal Sciences - heat transfer, fluid mechanics, multiphase flow, non-equilibrium phase change, development of novel non-intrusive measurement techniques for industry and homeland security, wind tunnel design and application for environmental studies.

Selected List of Publications

1. A. Notea and E. Elias, Low Energy Photons from ^{152}Eu for Ge(Li) Calibration, Nucl. Instr. Methods, 86, 269-272 (1970).
2. E. Elias, Y. Segal and A. Notea, Backscattering of ^{137}Cs Gamma Rays by Finite Barriers, J. Nucl. Energy, 27, 351-362 (1973).
3. E. Elias, A. Notea and Y. Segal, Gamma Gauge for the control of Interzone Layer in an Extraction Tower, Nucl. Technol. 21, 57-66 (1974).

4. E. Elias, Y. Segal and A. Notea, Number and Energy Albedo, Annals Nucl. Sci. Eng. 1, 387-391 (1974).
5. E. Elias, Y. Segal and A. Notea, Gamma-Ray Build-up Factors for Finite Cylindrical Media, Nucl. Inst. Methods 131, 307-314 (1975).
6. E. Elias, A. Notea and Y. Segal, A Model for the Estimation of Photon Albedo Based on Single to Total Scattering Ratio, Nucl. Inst. Methods, 134, 331-338 (1976).
7. E. Elias, Y. Segal and A. Notea, Transmission of Gamma Radiation through Finite Cylindrical Barriers, Nucl. Technol. 28, 261-269 (1976).
8. E. Elias and G. Yadigaroglu, A General One-Dimensional Model for Conduction Controlled Rewetting of a Vertical Surface, Nucl. Engng. Design 42, 185-194 (1977).
9. E. Elias, Y. Segal and A. Notea, Dual Gauging Utilizing Penetrating and Scattered Photon Fluxes, Nucl. Technol. 33, 305-313 (1977).
10. P. L. Chambré and E. Elias, Boiling Heat Transfer during Rewetting, Nucl. Engng. Design 50, 353-363 (1978).
11. E. Elias and P. L. Chambré, The Development of a Cooling Wave on a Hot Surface, Nucl. Engng. Design 55, 9-15 (1979).
12. E. Elias and Y. Ben-Haim, Determination of Spatial Distribution in Two-Phase Flow Using Scattered Gamma Radiation, Nucl. Engng. Design 59, 433-441 (1980).
13. E. Elias, W. Pieters, and Z. Yom-Tov, Accuracy and Performance Analysis of a Nuclear Belt Weigher, Nucl. Inst. Methods, 178, 108-115 (1980).
14. A. Kenigsberg, D. Hasan and E. Elias, Parametric Study of Radioactive Release from a Breached Containment, Nucl. Technol. 50, 2219-224 (1980).
15. E. Elias and P. L. Chambré, Inverted Annular Film Boiling Heat Transfer from Vertical Surfaces, Nucl. Engng. Design 84, 249-257 (1981).
16. Z. Edelman and E. Elias, Void Fraction Distribution in Low Flow Rate Subcooled Boiling, Nucl. Engng. Design 66, 375-382 (1981). Also: ASME Paper 81-WA-HT-63
17. Y. Ben-Haim and E. Elias, Safety Implication of Stochastic Analysis of Nuclear Reactor Transients, Annals of Nuclear Energy 8, 497-507 (1981).
18. Y. Ben-Haim, E. Elias and A. Knoll, Nondestructive Analysis of Radwaste Containers, Nucl. Tecnol. 52, 121-128 (1981).
19. Y. Ben-Haim and E. Elias, Probabilistic Interpretation of Non-Destructive Assay of Nuclear Materials, Annals of Nuclear Energy 9, 1-9 (1982).
20. S. Kaizerman, E. Wacholder and E. Elias, Numerical Analysis of the Stability and Transient Behaviorof Natural Convection Loops, Int. J. Engineering Science, 20 (11), 1235-1254 (1982).
21. S. Kaizerman, E. Wacholder and E. Elias, "Stability and Transient Behavior of a Vertical Toroidal Thermosyphon", ASME Paper 81/WA/HT-11 (1981).
22. Y. Ben-Haim, E. Elias and T. Gozani, Probabilistic Approach to Nondestructive Assay of Containers with Non-Uniform SNM Distribution, J. Nuclear Material Management XI, 69-81 (1982).

23. S. Kaizerman, E. Wacholder and E. Elias, Characteristics Analysis of Inhomogeneous, Nonequilibrium, Two-Phase Flows Using the Drift-Flux Model, Nucl. Sci. Engng., 84, 168-173 (1983).

24. S. Kaizerman, E. Wacholder and E. Elias, A Drift-flux Model Flow-Regime Map of Two-Phase Flows for Thermal-Hydraulic Calculations, Nucl. Sci. Engng., 84, 166-168 (1983).

25. Z. Edelman, D. Naot and E. Elias, Optical Visualization of Liquid Penetration to the Vapor Film in Inverted Annular Boiling, Int. J. Heat and Mass Transfer 26, 1715-1717 (1983).

26. Critical E. Elias and P. L. Chambré, A Mechanistic Non-Equilibrium Model for Two-Phase Flow, Int. J. Multiphase Flow 10, 21-40 (1984).

27. Z. Edelman, E. Elias and D. Naot, Inverted Annular Boiling in Stainless Steel Tube with Steady Heat Sources, Int. J. Heat Mass Transfer 28, 1281-1292 (1985).

28. Y. Ben-Haim and E. Elias, Indirect Measurement of Surface Temperature and Heat Flux: Optimal Design using Convexity Analysis, Int. J. Heat Mass Transfer 30, 1673-1684 (1987).

29. S. Olek, Y. Zvirin and E. Elias, Rewetting of Hot Surfaces by Falling Liquid Films as a Conjugate Heat Transfer Problem, Int. J. Multiphase Flow 14(1), 13-33 (1988).

30. S. Olek Y. Zvirin and E. Elias, The Relation between the Rewetting Temperature and the Liquid-Solid Contact Angle, Int. J. Heat and Mass Transfer 31(1), 898-902 (1988).

31. A. Ketter, E. Wacholder and E. Elias, Iodine Removal by Condensation from Containment Atmosphere in Post External Event Conditions, Nucl. Engng. Design 108, 385-393 (1988).

32. S. Kaizerman, E. Wacholder, E. Elias and N. Toomarian, COTHA: A Computer Code for Transient Analysis of Thermal-Hydraulic Phenomena in LWR's and HWR's Cores, Energia Nucleare 6(1), 47-55 (1989).

33. S. Olek Y. Zvirin and E. Elias, Bubble Growth Prediction by the Hyperbolic and Parabolic Heat Conduction Equations, Ẅarme-und Stoffübertragung 25, 17-26 (1990).

34. S. Olek Y. Zvirin and E. Elias, A Simple Correlation for the Minimum Film Boiling Temperature, ASME Journal of Heat Transfer, 113, 263-264 (1991).

35. D. Gal, D. Saphier and E. Elias, A DSNP Movable Boundary U-Tube Steam Generator Model, Nucl. Technology 95, pp. 64-76 (1991).

36. S. Olek, E. Elias, E. Wacholder, and S. Kaizerman, Unsteady Conjugated Heat Transfer in Laminar Pipe Flow, Int. Jr. of Heat and Mass Transfer 34(6), 1443-1450 (1991).

37. E. Elias and P. L. Chambré, Flashing Inception in Water during Rapid Decompression, ASME J. Heat Transfer 115, 231-238 (1992) (The Landau Award, 1993).

38. R. Dagan, E. Elias, E. Wacholder and S. Olek, A Two-Fluid Model for Critical Flashing Flows in Pipes, Int. J. Multiphase Flow 19, 15-25 (1993).

39. I. Arshavski, Y. Nekhamkin, S. Olek and E. Elias, Conjugate Heat Transfer in an Open Loop Thermosyphon, Int. Comm. Heat Mass Transfer 21(2), 153-166 (1994).

40. L. Ruby and E. Elias, Satisfying Boundary Conditions in Three Dimensions, Annals of Nuclear Energy, 21, 303-307 (1994).
41. Y. Barnea, E. Elias and I. Shai, Flow and Heat Transfer Regimes during Quenching of Hot Surfaces, Int. J. Heat Mass Transfer, 37(10), 1441-1453 (1994).
42. S. Olek, E. Wacholder and E. Elias, Analytical Solution of Two-Dimensional Diffusion in a Composite Medium with Application to Cooling of Reactor Fuel Elements, Nucl. Engng. and Design, 150, 49-60 (1994).
43. E. Elias and T. Gozani, Accurate Hydrogen Determination with Dual Nuclear Gauge, Nucl. Instruments and Methods in Physics Research A 353, 691-694 (1994)
44. R. Loveman, T. Gozani, J. Bendahan, J. Krivicich, E. Elias and E. Altschuler, Utilization of a BGO Detector as an Active Oxygen Target, Nucl. Instruments and Methods in Physics Research A 353, 508-511 (1994).
45. I. Arshavski, Y. Nekhamkin, S. Olek and E. Elias, Conjugate Heat Transfer during Falling Film Evaporation, Int. Comm. Heat Mass Transfer 22(2), 271-284 (1995).
46. E. Wacholder, E. Elias and Y. Merlis, Artificial Neural Networks Optimization Method for Radioactive Source Localization, Nucl. Technol. 110(2), 228-237 (1995).
47. L. Ruby and E. Elias, Satisfying Boundary Conditions in Three Dimensions: Addendum, Annals of Nuclear Energy, 23, 1077-1078 (1996).
48. L. Ruby, M. Becker and E. Elias, A New Method of Benchmarking Diffusion Codes, Annals of Nuclear Energy 25(8), 481-486 (1998).
49. E. Elias, V. Sanchez and W. Hering, Development and Validation of a Reflood Model for the RELAP5/MOD3 Code, Nucl. Engng. Design 183(3), 269-286 (1998).
50. L. Ruby and E. Elias, Benchmarking a Diffusion Code for a Cylindrical-Core Reactor, Annals of Nuclear Energy 26, 977-982 (1999).
51. E. Elias and P. L. Chambré, Bubble Transport in Flashing Flow, Int. J. Multiphase Flow 26, 191-206 (2000).
52. Ran Yaron, Ray Radbough, Ezra Elias and Lev Ostrovsky, Thermoacoustic microengines, The Journal of the Acoustical Society of America, 107(5), 2795 (2000) {Short Note}
53. A. Davidy, E. Elias and S. Olek Quenching of Hot Oxidizing Surfaces, Nucl. Engng. Design, 204(2), 361-368 (2001).
54. D. Hasan, Y. Nekhamkin, V. Roseband, E. Elias, A. Gani and W. Wacholder, An Exact Solution for the Moving Boiling Boundary Problem, Nucl. Engng. Design 203(1), 243-248 (2001).
55. H. Li, E. Elias and A.S. Mujumdar, Theoretical Simulation of Explosive Boiling, Int. Comm. Heat Mass Transfer 32(5), 612-619 (2005).
56. E. Elias and M. Shusser, Lifetime of a Superheated Liquid, Heat Mass Transfer 42(1), 51-55 (2005).
57. E. Elias and P. L. Chambré, Limit of Superheat in Uniformly Heated Fluid, Heat Mass Transfer 43, 957-963 (2007).
58. E. Elias and P. L. Chambré, Liquid Superheat during Nonequilibrium Boiling, Heat Mass Transfer Vol. 45, 659−662 (2008).

59. E. Weiss, D. Zoler, S. Wald and E. Elias, Modeling of Electrical Confined-Capillary-Discharge where the Discharge Zone is Extended by an Additional Pipe, Physics Letters A Vol. 373, 972−975 (2009).
60. Haustein H.D., Gany A. and Elias E., Rapid Boiling of a Two-Phase Droplet in an Immiscible Liquid at High Superheat, *Journal of Heat Transfer*. 131(12), 121010 (Oct 15 2009); doi: 10.1115/1.3220146
61. Ben-Zion Maytal and Ezra Elias**,** Two-phase choking conditions of real gases flow at their critical stagnation temperatures and closely above, Cryogenics 49, 469−481 (2009). available online at doi:10.1016/j.cryogenics.2009.06.009
62. Haustein H. D., Gany A., Dietze G. F., Elias E. and Kneer R., " The Dynamics of Bubble Growth at Medium-High Superheat: Boiling in an Infinite Medium and on a Wall ", *Journal of Heat Transfer*. 135(7), 071501 (Jun 06 2013); doi: 10.1115/1.4023746
63. Y. Shaposhnik, E. Shwageraus, and E. Ezra, "Core Design Options for High Conversion BWRs Operating in Th^{233}-U Fuel Cycle", Nucl. Engng. & Design, 263, 193-205 (2013).
64. T. Gozani, J. Bendahan, M.J. King, C. Brown, M. Elsalim and E. Elias, Differential time of flight technique for the detection of special nuclear materials, IEEE transactions on Nuclear Sciences Vol 60 No.(2), 1118-1125, April 2013.
65. Y. Shaposhnik, E. Shwagerausa, and E. Elias, Shutdown Margin for High Conversion BWRs Operating in Th-^{233}U Fuel Cycle, Nucl. Engng. & Design. 276, 162-177 (2014). Also arXiv:1309.7214
66. E. Elias, D. Hasan, Y. Nekhamkin, Zirconium ignition in exposed fuel channel, Nucl. Engng. & Design. 286, 205-210 (2015)
67. E. Elias1, D. Hasan1, Y. Nekhamkin1, P. Trinuruk, Criterion for cladding runaway oxidation during Loss of Flow Accident (LOFA) in Nuclear Reactors, Int. J. Engineering Science ISSN 0976 – 6693, IJES 11(1), 1-6 (2018)
68. Herman D. Haustein, Alon Gany, Ezra Elias, Multiphase Marine Ramjet Using Liquefied Gas as a Source of Bubbles, J. Mar. Sci. Eng. 2020, 8, 710; doi:10.3390/jmse8090710
69. E. Elias, Y. Nekhamkin, D. Hasan, J. Dayan, Cladding ignition in partially exposed fuel channel, Proceeding of ENS TopFuel Conference, Santander, Spain, October 2021, ISBN: 978-92-95064-35-5.

Review Papers

1. E. Elias and G. Yadigaroglu, The Reflooding Phase of the LOCA-State of the Art: Rewetting and Liquid Entrainment, Nucl. Safety 19 (2), 160-175 (1978); (Technical Communication Award, 1979).
2. E. Elias and G. Lellouche, Two Phase Critical Flow, Int. J. Multiphase Flow, Vol 20 (Suppl.), 91-168 (1994).
3. S. Olek, Y. Zvirin and E. Elias, Rewetting of Hot Surfaces, in G. F. Hewitt, G. L. Shires and Y. V. Polezhaev (Eds.) International Encyclopedia of Heat and Mass Transfer, pp. 959-962, CRC Press LLC, Boca Raton (1997).
4. S. Olek, Y. Zvirin and E. Elias, Leidenfrost Phenomena, in G. F. Hewitt, G. L. Shires and Y. V. Polezhaev (Eds.) International Encyclopedia of Heat and Mass Transfer, p. 666, CRC Press LLC, Boca Raton (1997).