

VITAE

Mitsuru Kurosaka

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University of Washington, Seattle, Washington, Box 98195-2400 USA

AREAS OF INTEREST

Propulsion, Aeroacoustics, Detonation, Turbomachinery, Thermo-Fluid Mechanics

EDUCATION

Ph.D., Mechanical Engineering, California Institute of Technology, 1968 MS, Mechanical Engineering, University of Tokyo, 1961

BS, Naval Architecture and Marine Engineering, University of Tokyo, 1959

PROFESSIONAL EXPERIENCE

1987-present, Professor of Aeronautics and Astronautics, University of Washington

2007 Visiting Professor, L'Ecole Nationale Supérieure de Mécanique et d'Aérotechnique (ENSMA), Poitiers, France

1979-1987, Professor of Mechanical and Aerospace Engineering, University of Tennessee Space Institute

1984-1985, Visiting Professor, Department of Aeronautics and Astronautics, Massachusetts Institute of Technology (supported in full by the Air Force Office of Scientific Research and MIT)

1977-1979, Associate Professor of Mechanical and Aerospace Engineering, University of Tennessee Space Institute

1969-1977, Fluid Mechanics Engineer, General Electric Research and Development Center

1967-1969, Engineering Specialist, AiResearch Manufacturing Company

1964-1967, Graduate Teaching and Research Assistant, California Institute of Technology

1961-1963, Thermal Design Engineer, Hitachi Ltd., Tokyo TECHNICAL SOCIETIES

HONORS & AWARDS

Fellow, ASME: Associate Fellow, AIAA

AIAA General H.H.(Hap) Arnold Award, 1983

Professor of the Year, 1993, Department of Aeronautics & Astronautics, University of Washington

CONSULTING

General Electric Company, AiResearch Manufacturing Company (Phoenix), ARO Inc., Calspan Field Services, Pratt-Whitney Canada, Sundstrand Aerospace, Inhale Therapeutic Systems, Northwind Technology.

SERVICES

Committee member "Air Force and Department of Defense Aerospace Propulsion Needs", National Academy of Sciences, 2005-2006

• PUBLICATIONS

key:

* Refereed Journal Article

† Technical Report (excluding contract progress reports) # Abstract

o Conference Proceedings

†† Conference Paper

1. "Approximate Theory for the Flow Through a Cascade of Cambered Airfoils," Ph.D. Dissertation, California Institute of Technology (University Microfilms, Ann Arbor, MI), 1968.

†2. "Spatial Oscillation Within the Boundary Layer over a Rotating Surface," AiResearch Mfg. Co., Report No. 68-4361(1), Nov. 1968.

†3. "Applications of Momentum Integral Method to the Three-Dimensional Boundary Layer Formed Over Arbitrary-Shaped Impeller Hub and Shroud Surfaces," AiResearch Mfg. Co., Report No. 68-4361(2), Nov. 1968.

†4. "Computer Program for Calculation of Three-Dimensional Boundary Layer Formed Over Impeller Surfaces," AiResearch Mfg. Co. Report No. 68-4361(3), Nov. 1968.

†5. "The Generalized Integral Equation Method for Transonic Flow Past an Airfoil," AiResearch Mfg. Co. Report No. 69-5552, Sept. 1969.

*6. "A Note on Multiple Pure Tone Noise," *Journal of Sound and Vibration* 19(4):453-62 (1971).

†7. "The Theoretical and Experimental Investigations on Multiple Pure Tone Noise- Part 1" (with R.A. Kantola), NASA CR-1831, November 1971.

†8. "Aeromechanics Instability of a Supersonic Compressor Cascade," General Electric Co. Corporate Research and Development Report No. 71-C-189, Jan. 1971.

†9. "Summary of Investigations on Aeromechanical Instability of a Supersonic Compressor," General Electric Co. Corporate Research and Development Report No. 71-C-210, June 1971.

† 10. "A Memo on Underwater Propulsor Noise" (with S. D. Savkar), General Electric Co. Class IV Memorandum, Dec. 1971.

*11. "Theoretical and Experimental Investigations on Multiple Pure Tone Noise" (with R.A. Kantola), *Journal of Aircraft* 9(11):784-90 (1972).

†12. "Research on Noise Generation from Large Fan Engines" (with J.A. Asher and S.D. Savkar), General Electric Co. Corporate Research and Development Report No. SRD-72-079, July 1972.

†13. "Further Investigations of Multiple Pure Tone Noise," General Electric Co. Corporate Research and Development Report No. 72CRD 336, Dec. 1972.

*14. "The Oscillating Boundary Layer Growth Over the Top and Bottom Plates of a Rotating Channel," *Transactions of the American Society of Mechanical Engineers, Journal of Fluid Engineering* 95, Series I (1) (1973)

† 15. "Compressor Stall Anticipation" (with S. B. Tucker), General Electric Co. Aircraft Engine Business Group Technical Information Series, No. R73AEG159, June 1973.

* 16. "On the Unsteady Supersonic Cascade With a Subsonic Leading Edge - An Exact First Order Theory, Part 1," *Transactions of the American Society of Mechanical Engineers, Journal of Engineering for Power* 95(A):13-22 (1974).

* 17. "On the Unsteady Supersonic Cascade with a Subsonic Leading Edge - An Exact First Order Theory, Part 2," *Transactions of the American Society of Mechanical En-*

gineers, *Journal of Engineering for Power* 95(A):23-31 (1974).

††18. "A Discussion on 'Unsteady Aerodynamics of a Finite Supersonic Cascade With Subsonic Axial Flow' by J. M. Verdon," *Transactions of the American Society of Mechanical Engineers, Journal of Applied Mechanics* 41(E, no. 2) (1974).

*19. "On the Flow Field External to a Rapidly Oscillating Airfoil in a Supersonic Flow," *Journal of Fluid Mechanics* 62(4):811-27 (1974).

°20. "Unsteady Supersonic Flow Around an Airfoil," *Proceedings of a PROJECT SQUID Workshop on Unsteady Flows in Jet Engines*, pp. 223-36, Nov. 1974.

*21. "On the Issue of Resonance in Unsteady Supersonic Cascade," *AIAA Journal* 13(11):1514-16 (1975).

*22. "Unsteady Pressure Distributions on Oscillating Airfoils in a Supersonic Cascade," *Transactions of the American Society of Mechanical Engineers, Journal of Engineering for Power* 98(A):553-54 (1976).

*23. "Some Recent Developments in Unsteady Aerodynamics of a Supersonic Cascade" (with I.H. Edelfelt), *Revue Française de Mécanique, Numéro Spécial*, pp. 56-64 (1976).

†24. "Formulation for Transonic Cascade Unsteady Aero Coefficients" (with S.D. Savkar), *General Electric Co. Corporate Research and Development Report No. 76CRD078*, May 1976.

*25. "Cumulative Nonlinear Distortion of an Acoustic Wave Propagating Through an Inhomogeneous Flow," *Journal of Fluid Mechanics* 83(4):751-73 (1977).

†26. "Unsteady Blade Rows in High-Speed Flow," *Final Scientific Report to the Air Force Office of Scientific Research, Contract No. F44620-74-C-0040*, May 1978.

†27. "Evaluation of a New Concept for the Generation of Unsteady Flow in a Transonic Wind Tunnel" (with J.L. Jacock and T. Hsieh), *U.S. Air Force Arnold Engineering Development Center, Report AEDC-TR-79-8*, March 1979.

°28. "Linear and Nonlinear Analysis of Vortex Whistle - Another Blade Buster," *Proceedings of the Second International Symposium of Aeroelasticity in Turbomachines, Lausanne, Switzerland (Zurich: Juris-Verlag)*, pp. 443-53, Sept. 1980.

††29. "Vortex Whistle: An Unsteady Phenomenon in Swirling Flow and Its Effect on Steady Flow Field," *AIAA Paper 81-0212, AIAA 19th Aerospace Sciences Meeting, St. Louis, MO, Jan. 12-15, 1981*.

††30. "Acoustic Streaming as a Mechanism of the Ranque-Hilsch Effect" (with J.R. Goodman and J.Q. Chu), *Bulletin of the American Physical Society* 26(9) (1981).

††31. "Ranque-Hilsch Effect revisited: Temperature Separation traced to Orderly Spinning Waves or 'Vortex Whistle'" *AIAA Paper 82-0592, presented at AIAA/ASME 3rd joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, St. Louis, MO, June 7-11, 1982*.

*32. "Aerodynamic Interaction of Heat Transfer With Steady Transonic Flow" (with H. Kuroda, H.P. Chou and J.M. Wu), *AIAA Journal* 20(2):184-89 (1982).

#33. "Acoustic Streaming as a Mechanism of the Ranque-Hilsch Effect" (with J.R. Goodman and J. Q. Chu), *Proceedings of the Ninth U.S. Congress of Applied Mechanics, Cornell University, Ithaca, NY*, p. 487 (1982).

*34. "Coriolis Resonance Within a Rotating Duct" (with J.E. Caruthers), *AIAA Journal* 20(8):1148-50 (1982).

#35. "Acoustic Streaming Induced by the 'Vortex Whistle' Is the Cause of the Ranque-Hilsch Effect" (with J.R. Goodman and J.Q. Chu), *Journal of the Acoustical Society of America* 72(Suppl. 7):S.12 (1982).

*36. "Acoustic Streaming in Swirling Flow and the Ranque-Hilsch Effect," *Journal of*

Fluid Mechanics 124:139-72 (1982).

†37. "Unsteady Swirling Flows in Gas Turbines" AFOSR Report No. AFOSR-TR83-1006, Final Scientific Report to the Air Force Office of Scientific Research, Contract No. F 49620-78-C-0045, Feb. 1983.

††38. "An Interplay Between Acoustic Waves and Steady Vortical Flow" (with J.R. Goodman, H. Kuroda and J. Q. Chu), AIAA Paper No. 83-0740, AIAA 8th Aeroacoustic Conference, Atlanta, GA, April 1983.

39. "The Ranque-Hilsch Effect" in Physics News in 1983, by P.F. Schewe, American Institute of Physics, pp. 99-100, Nov. 1983; also in Physics Today, p. S 34-35, Jan. 1984.

#40. "Enhancement of Temperature Drop Behind Cylinders by Acoustic Synchronization (with J.R. Goodman and W.C. Riner), Bulletin of the American Physical Society 29(9):1557 (1984).

#4 1. "Separation of Total Temperature in a Kármán Street" (with J.B. Gertz, J.E. Graham, W.L. Hankey and P. Sundaram), Bulletin of the American Physical Society 30(10):1717 (1985).

*42. "Illustrative Examples of Streaklines in Unsteady Vortices: Interpretational Difficulties Revisited" (with P. Sundaram), Physics of Fluids 29(10):3474-77 (1986).

*43. "Energy Separation in a Vortex Street" (with J.B. Gertz, J.E. Graham, J.R. Goodman, P. Sundaram, W.C. Riner, H. Kuroda and W.L. Hankey), Journal of Fluid Mechanics 178:1-29 (1987).

††44. "Negative Entropy Spots Behind a Cylinder Immersed in Shear Flow" (with F.F. Marble, J.R. Goodman and R.A. Wohlman), Bulletin of the American Physical Society 32(10):2098 (1987).

*45. "Crossflow Transport Induced by Vortices" (with W.H. Christiansen, J.R. Goodman, L. Tirres and R.A. Wohlman), AIAA Journal 26(11):1403-5 (1988).

*46. "Negative Heat Transfer in Separated Flows" (with J.E. Graham and J.S. Shang), International Journal of Heat and Mass Transfer 32(6):1192-95 (1989).

#47. "Total Temperature Separation in an Impinging Jet" (with M.D. Fox and K. Hirano), Bulletin of the American Physical Society 34(10):2273 (1989).

*48. "Time-Resolved Measurements of Total Temperature and Pressure in the Vortex Street Behind a Cylinder" (with W.F. Ng and W.M. Chakroun), Physics of Fluids 2(6):971-78 (1990).

††49. "Vortex-Induced Total Temperature Separation in an Obstructed Flow" (with J.J. O'Callaghan), Bulletin of American Physical Society 35(10):2226 (1990).

††50. "Vortex-Induced Cooling in a Supersonic Impinging Jet" (with M.D. Fox), Bulletin of American Physical Society 35(10):3207 (1990).

*51. "Vortex Dynamics Analysis of Unsteady Vortex Wakes" (with P. Sundaram and J.M. Wu), AIAA Journal 29(3):321-26 (1991).

°52. "Vortex-Induced Cooling Effects in Impinging Jets" (with M.D. Fox and K. Hirano), Proceedings of the 1991 Yokohama International Gas Turbine Congress 2:165-68 (1991).

††53. "Total Temperature Separation in an Underexpanded Free Jet" (with M.D. Fox), Bulletin of American Physical Society 36(10):2716 (1991).

††54. "Vortex-Induced Energy Separation in Shear Flows" (with J.J. O'Callaghan), AIAA Paper 92-0192, AIAA 30th Aerospace Sciences Meeting, Reno, NV, Jan. 1-9, 1992.

††55. "An Unsteady Extension of the Invariance of the Total Temperature across a Boundary Layer" (with M.D. Fox), Bulletin of American Physical Society 37 (8): 1768 (1992).

*56. "The Influence of Vortical Structures on the Thermal Fields of Jets" (with M.D. Fox,

- L. Hedges and K. Hirano), *Journal of Fluid Mechanics* 255 (10):447-472 (1993);also 1994, corrigendum, 261(25 February).
- *57. "Hairpin Vortex-Induced Cross Flow Transport -the 'Tornado Effect' "(with J.P. Hagen) *Physics of Fluids A Fluid Dynamics*, 5(12):3167-3174 (1993).
- *58. "Vortex-Induced Energy Separation in Shear Flows" (with J.J. O'Callaghan), *AIAA Journal* 31(6):1157-1159 (1993).
- ††59. "The 'Tornado Effect' in Hairpin Vortices" (with J.P.Hagen), *Bulletin of American Physical Society* 38(12):2312 (1993).
- * 60. "Supersonic cooling by shock-vortex interaction" (with M.D. Fox),*Journal of Fluid Mechanics* 308 (10 February): 3 63 -379 (1996).
- * 61. "Supersonic cooling in impinging jets" (with M.D. Fox), prepared for publication.
- ††62. "The Generating Mechanism of Kidney-Shaped Vortices in Cross-Flow Jets" (with B.A. Haven), *Bulletin of American Physical Society* , 39(9):1962 (1994).
- ° 63. "Effect of Hole Geometry on Jets in Crossflow."(with B.A. Haven) *Proceedings of the 7th International Symposium on Flow Visualization*, Seattle, Washington, September 11-14, 1995, pp.468-472.
- #64. "Active Control of Vortex Breakdown"(with M.Kikuchi, K.Hirano, and T. Yuge), *Bulletin of American Physical Society*, 40(12):2044 (1995).
- ††65. "The Effect of Hole Geometry on Lift-Off behavior of Coolant Jets" (with B.A.Haven), *AIAA Paper 96-0618*, 34th Aerospace Sciences meeting & Exhibit, January, 15-18, Reno, NV (1996).
- *66. "Improved Jet Coverage Through Vortex Cancellation" (with B.A. Haven), *AIAA Journal*, vol.34, No. 11, pp. 2443-2444, 1996.
- ††67. "Anti-kidney pair vortices in crossflow jets" (with B.A. Haven), *Bulletin of American Physical Society*, 41(9):1711 (1996).
- ††68. "Anti-Kidney Pair of Vortices in Shaped Holes and their Influence on Film Cooling Effectiveness" (with B.A. Haven, D.K.Yamagata, S. Yamawaki, T. Maya), *ASME Paper 97-GT-45*, *ASME Turbo EXPO '97 -Land, Sea & Air*, *International Gas Turbine & AeroEngine Congress & Exhibition*, Orlando, Florida, June 2-5, (1997).
- *69. "Kidney and anti-kidney vortices in crossflow jets" (with B.A. Haven), *Journal of Fluid Mechanics.*, vol.352, pp.27-64,(1997).
- °70. "Spiralling Shear Layer as a Cause of Vortex Breakdown", Paper No. 152, *Proceedings of the 8th International Symposium on Flow Visualization*, CD-ROM *Proceedings*, ISBN 0 9533991 0 9, Sorrento, Italy, Sept. 1-4, 1998. Archived at National Library of Scotland, Legal Deposit and Donations Unit, 31 Salisbury Place, Edinburgh EH9 1 SL, Scotland, UK.
- ††71. "Wing-Shaping to Suppress Vortex Breakdown"" (with S. Srigrarom), *Bulletin of American Physical Society*, 44(8):93 (1999).
- *72. "Shaping of Delta Wing Planform to Suppress Vortex Breakdown" (with S. Srigrarom), *AIAA Journal.*, vol.38, No. 1, pp.183-186,(2000).
- *73. "Surface Shaping to Suppress Vortex Breakdown on Delta Wings" (with S. Srigrarom), *AIAA Journal.*, vol.38, No. 1, pp.186-187,(2000).
- ††74. "Transient Formation of Vortex Breakdown-Vortex Filament Simulation"" (with C. B. Cain & S. Srigrarom), *Bulletin of American Physical Society*, 45(9):29 (2000).
- ††75. "Transient Formation of Vortex Breakdown over Delta Wing-Experiment"" (with C. B. Cain & S. Srigrarom), *Bulletin of American Physical Society*, 45(9):29 (2000).
- ††76. "Transient Formation of Vortex Breakdown over Delta Wing" (with S.Srigrarom & C. B. Cain), *Proceedings of the Fourth Pacific International Aerospace Science and*

Technology, Kaosiung, Taiwan, May 21-23 (2001).

††77. “Occurrence of vortex breakdown on the model wings” (with S. Srigrarom), Bulletin of American Physical Society, 47(10):72 (2002).

*78. “Interchangeability of Vortex Breakdown Types” (with M.Kikuchi, K. Hirano, T.Yuge and H.Inoue), Experiments in Fluids., vol.34,pp.77-86,(2003).

#79. “An explicit connection between radial changes in vortices and azimuthal vorticity gradient” Bulletin of American Physical Society, 49(9):127(2004).

*80. “Azimuthal vorticity-gradient in the formative stages of vortex breakdown” (with C.B. Cain, S. Srigrarom, J.D. Wimer, D. Dabiri, W.F. Johnson, J.C. Hatcher, B.R. Thompson, M.Kikuchi, K. Hirano, T.Yuge and T.Honda), vol 569, pp.1-28, Journal of Fluid Mechanics (2006).

††81. “ Flow Reversal in Spinning Detonation” (with Virof, F., Khassinov, B., Desbordes, D., and Presles, H.N.) 17th International Symposium on Hazards, Prevention, and Mitigation of Industrial Explosions Conference, St. Petersburg, Russia, July 11th, 2008

††82. “ Eckert-Weise Energy Separation and Base Drag in the Wakes of Turbine Blades and Circular Cylinders” (with J.P. Gostelow and W.E. Carscallen), 14th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, ISROMAC-14, February 27th, March 2nd, Honolulu, 2012.

o 83. “The Relationship between Energy Separation and Base Drag in Turbine Blade Wakes” (with J.P. Gostelow , W.E. Carscallen, and A. Mahallati), Proceedings of IGTI 2013 ASME Turbo Expo 2013: Power for Land, Sea and Air June 3-7, 2013, San Antonio, TX, USA Paper number GT2013-94936

*84. “Spinning detonation, cross-currents, and the Chapman-Jouguet velocity”(with N. Tsuboi), vol. 756, pp.728-757, Journal of Fluid Mechanics (2014) published online 04 September 2014(Copyright: Cambridge University Press).