

T.-W. Lee

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EXPERIENCE

- Principal and co-principal investigator in research projects funded by the National Science Foundation, Department of Energy, Federal Aviation Administration, and power generation and engine companies.
- Expertise in experiment and simulations of combustion processes, energy systems, and key thermal-fluid phenomena (fuel cells, chemical reaction, radiation, energy storage, photovoltaic silicon growth, and urban-scale thermal transport).
- 24 research projects funded by a power generation company (SRP) since 2001, on diverse energy-related topics (renewable energy, fuel cells, hydro-power, steam power, building energy).
- Author of three books titled “Thermal and Flow Measurements (2008)”, “Military Technologies of the World, Vols. I and II (2010)”; Editorial board in International Journal of Low-Carbon Technology and Handbook of Fluid Mechanics.
- Synergistic collaborations with experts in nano-fabrication and manufacturing (A.A. Tseng, ASU), smart energy materials (P.E. Phelan, ASU), gas-turbine heat transfer (R. Roy, ASU) and combustion synthesis (D.K. Seo, ASU).
- Familiarity with commercialization of engineering innovations (consulting experience with Orbital Science Corporation, Honeywell Engines, McDonnell Douglas Helicopters, Auer Precision, Inc.).

EDUCATION

Ph.D. (Aerospace Engineering) University of Michigan, Ann Arbor, MI.
M.S.E. (Aerospace Engineering) University of Michigan, Ann Arbor, MI.
B.S. (Aeronautical and Astronautical Engineering) Ohio State University,
Columbus, OH.

ACADEMIC EXPERIENCE

8/99 - Present Associate Professor, Department of Mechanical and Aerospace
Engineering, Arizona State University
5/06 – 8/06 Faculty Summer Fellow, NASA Glenn Research Center
8/93 - 5/99 Assistant Professor, Department of Mechanical and Aerospace
Engineering, Arizona State University, Tempe, AZ
1/90 - 7/93 Research Associate, Department of Mechanical Engineering, Penn
State University, University Park PA
9/86 - 1/90 Research Assistant, Department of Aerospace Engineering,
University of Michigan, Ann Arbor, MI
9/85 - 5/86 Teaching Assistant, Department of Aerospace Engineering,
University of Michigan, Ann Arbor, MI

HONORS & AWARDS

- 2006 NASA Faculty Summer Fellowship
- 2001 US Patent No. 6,216,756 (with Ampere Tseng) "Apparatus and Method for Manufacturing a Three-Dimensional Object".
- 2001 US Patent No. 6,309,711B1 (with Ampere Tseng) "Apparatus and Method for Manufacturing a Three-Dimensional Object".
- 1994 National Science Foundation Research Initiation Grant
- 1987 Rackham Pre-doctoral Fellowship, University of Michigan
- 1984 Woodin Memorial Scholarship, Ohio State University

PROFESSIONAL SERVICE

- Editorial Board, International Journal of Low-Carbon Technology
- Editorial Board, Handbook of Fluid Mechanics, CRC Press
- Panel Member, NSF Graduate Research Fellowship Program
- Reviewer, Combustion and Flame
- Reviewer, AIAA Journal of Propulsion and Power
- Reviewer, International Symposia on Combustion
- Reviewer, National Science Foundation, CTS and CBET Programs
- Panel Review Member, National Science Foundation Research Equipment Review Panel

BOOKS

- Thermal and Flow Measurements, CRC Press/Taylor and Francis, 2008.
- Military Technologies of the World, Vols. I and II, Praeger Security International, 2010.
- Aerospace Propulsion, Wiley, 2013

REFEREED JOURNAL PUBLICATIONS

1. Lee, T.-W., Gore, J.P., Faeth, G.M. and Birk, A. (1988). "Analysis of Combusting High-Pressure Monopropellant Sprays", Combustion Sci. and Tech., Vol. 57, pp. 95-112.
2. T.-W., Tseng, L.K. and Faeth, G.M. (1989). "Separated Flow Considerations for Pressure Atomized Combusting Monopropellant Sprays", AIAA Paper 89-0049; also, J. Prop. Power, Vol. 6, pp. 382-391.
3. Lee, T.-W. and Faeth, G.M. (1990). "Structure and Mixing Properties of Combusting Monopropellant Sprays", AIAA Paper 90-0463; also, J. Prop. Power, Vol. 8, pp. 271-279.
4. Lee, T.-W., North, G.L. and Santavicca, D.A. (1992). "Curvature and Orientation Statistics of Turbulent Premixed Flame Fronts", Combustion Sci. and Tech., Vol. 84, pp. 121-132.
5. Lee, T.-W. and Santavicca, D.A. (1993). "Flame Front Geometry and Stretch during Interactions of Premixed Flames with Vortices", Combustion Sci. and Tech., Vol. 90, pp. 211-229.
6. Lee, T.-W., North, G.L. and Santavicca, D.A. (1993). "Surface Properties of Turbulent Premixed Propane/Air Flames at Various Lewis Numbers", Combustion and Flame, Vol. 93, pp. 445-456.
7. Lee, T.-W., Lee, J.G., Nye, D.A. and Santavicca, D.A. (1993). "Local Response and Surface Properties of Premixed Flames During Interactions with Karman Vortex Streets", Combustion and Flame, Vol. 94, pp. 146-160.

8. Quay, B., Lee, T.-W., Ni, T. and Santoro R. J. (1994). "Spatially-Resolved Measurements of Soot Volume Fraction Using Laser-Induced Incandescence", Combustion and Flame, Vol. 97, pp. 384-392.
9. Lee, T.-W. (1995). "Scaling of Vortex-Induced Flame Stretch Profiles" Combustion Sci. and Tech., Vol. 102, pp. 301-307.
10. Lee, J.G., Lee, T.-W., Nye, D.A. and Santavicca, D.A. (1995). "Lewis Number Effects on Premixed Flames Interacting with Turbulent Karman Vortex Streets", presented at Twenty-Fifth Symposium (International) on Combustion, published in Combustion and Flame, Vol. 100, pp. 161-168.
11. Lee, T.-W., Shankland, R. and Fenton, M. (1995). "Flame Curvature Statistics in Axisymmetric Turbulent Jet Flames", Combustion Sci. and Tech., Vol. 108, pp. 31-46.
12. Lee, T.-W. and Mitrovic, A. (1996). "Liquid Core Structure of Pressure-Atomized Sprays via Laser Tomographic Imaging", Atomization and Sprays, Vol. 6, pp. 111-126.
13. Nye, D.A., Lee, J.G., Lee, T.-W. and Santavicca, D.A. (1996). "Flame Stretch Measurements during the Interaction of Premixed Flames and Karman Vortex Streets Using PIV", Combustion and Flame, Vol. 105, pp. 167-179.
14. Lee, T.-W. and Mitrovic, A. (1997). "Highly Turbulent Premixed Flames Stabilized in a Co-Axial Jet Flame Burner", Twenty-Sixth Symposium (International) on Combustion, p. 455.
15. Lee, T.-W., Fenton, M. and Shankland, R. (1997). "Effects of Variable Partial Premixing on Turbulent Jet Flame Structure", Combustion and Flame, 109: 536.
16. Lee, T.-W. and Mitrovic, A. (1997). "Structure of Lean Turbulent Premixed Flames Stabilized in a Co-Axial Jet Flame Burner", Combustion Sci. and Tech., 127:231.
17. Mitrovic, A. and Lee, T.-W. (1998). "Soot Formation Characteristics of Laminar Partially Premixed Flames", Combustion and Flame, 115:437.
18. Lee, T.-W. and Tseng, A.A. (1998). "Planar and Variable-Diameter Jets for Uniform Droplet Sprays", Journal of Metal, Vol. 50, p. 24.
19. Lee, T.-W. and Mitrovic, A. (1999). "Soot Volume Fraction Measurements in the Soot Forming Region of Ethylene-Air Turbulent Partially Premixed Flames", Combustion Sci. and Tech., 140:29.
20. Lee, T.-W. and Mitrovic, A., and Wang, T. (1999). "Structure of Turbulent Partially Premixed Flames: Partial Premixing of Fuel in Premixed Streams", Combustion and Flame, 121:378.
21. Lee, T.-W. (2000). "Ignition Mechanisms of Jet-A Fuel Vapor in Confined Environment", AIAA Journal, 38, 1989.
22. Lee, T.-W., Kozola, S. and Jain, V (2001). "Measurements of Ignition Energy Using Laser Sparks for Hydrocarbon Fuels: Propane, Dodecane and Jet-A Fuels", Combustion and Flame, 125:1320.
23. Lee, T.-W. and Lee, S.J. (2003). "Direct Comparison of Turbulent Flame Propagation Speed with Flame Surface Properties", Combustion and Flame, 132: 492.
24. Lee, T.-W. (2004). "Orientation-Averaged Light Extinction Characteristics of Compound Particles Including Aggregate Effects", Journal of Optical Society of America, A.
25. Lee, T.-W. and Hegde, N. (2005). "Laser-Induced Breakdown Spectroscopy for In-Situ Diagnostics of Combustion Parameters Including Temperature", Combustion and Flame, 142, 314.
26. Vadakapattu, V.C. and Lee, T.-W. (2006). "Multi-Dimensional Simulations of Thermal Barrier Coating", Surface and Coating Technology, 201, 1065.

27. Hegde, N., Han, I. and Lee, T.-W. and Roy, R. (2007). "Flow and Heat Transfer and Heat Recovery Steam Generator", ASME Journal of Energy Resources Technology, 129, 232.
28. Tyagi, H., Phelan, P.E., Prasher, R., Peck, R. and Arentzen, P. (2008). "Increased Hot-Plate Ignition Probability for Nanoparticle-Laden Diesel Fuel", Nanoletters, 10, 1021.
29. Tseng, A., Lee, T.-W., Notargiacomo, A. and Chen, T.P. (2009), "Formation of uniform nanoscale oxide layers assembled by overlapping oxide lines using atomic force microscopy", Journal of Micro/Nanolithography MEMS, MOEMS, 8(4), 043050.
30. Jeong, H.M., Chung, H.S. and Lee, T.-W. (2009), "Computational Simulations of Ribbon-Growth on Substrate for Photovoltaic Silicon", J. Crystal Growth, 312, 555-562.
31. Lee, T.-W., Tseng, A., Bae, K.-S. and Do, Y.H., (2010), "Simulation of the PEM Fuel Cell Life-Cycle Performance with Data-Driven Parameter Estimation", Energy and Fuels, 24 (3), pp 1882–1888.
32. Lee, T.-W. and Ho, A. (2010), "Scaling of the Urban Heat Island Effect Based on the Energy Balance", Climate Research, Vol. 42, 209–216.
33. Lee, T.-W. and Robinson, D. (2011), "A Method for Direct Calculations of the Drop Size Distribution and Velocities from the Integral Form of the Conservation Equations", Combustion Science and Technology, Volume 183, Issue 3, pp. 271 – 284.
34. Dimitrescu, A., Lee, T.-W. and Roy, R. (2011), "Computational Model of a Hybrid Pressurized Solid Oxide Fuel Cell Generator/Gas Turbine Power Plant, ASME Journal of Energy Resources Technology, 133, 012602.
35. Lee, T.-W., Singh, H., Lee, J.Y., Jeong, H.-M. and Sturm, D. (2011), "Computational Simulations and Optimization of Flow and Temperature Distributions in a Large-Scale Power Plant Building", Building Simulation, Vol. 4, No. 4, pp. 341-350.
36. Lee, T.-W. and Lee, J.Y. (2012), "Momentum Effects on Drop Size, Calculated Using the Integral Form of the Conservation Equations", Combustion Science and Technology, 184:434-443.
37. Lee, T.-W., Lee, J.Y. and Z.H. Wang (2012), "Scaling of the Urban Heat Island Intensity Using the Time-Dependent Energy Balance", Urban Climate, Urban Climate 2, 16–24.
38. Jiachuan Yang, Zhi-Hua Wang, T.-W. Lee (2013), "Relative Efficiency of Surface Energy Partitioning over Different Land Covers", British Journal of Environment and Climate Change, Vol. 3, Issue 1, pp. 86-102.
39. Lee, T.-W. and Ryu, J.H. (2014), "Analyses of Spray Break-Up Mechanisms Using the Integral Form of the Conservation Equations", Combustion Theory and Modeling, 18 (1), 89-100.
40. Lee, T.-W., Choi, H.S. and Bae, K.S. (2014), "Simulation of the Oxygen/Drug Delivery in Three-Dimensional Capillary Network", Biomathematics, Vol. 2014, 359327.
41. Lee, T.-W. Choi, H.S. and Lee, J. (2014), "Generalized Scaling of Urban Heat Island Effect and Its Applications for Energy Consumption and Renewable Energy", Advances in Meteorology, <http://dx.doi.org/10.1155/2014/948306>.
42. T.-W. Lee, K.-S. Bae, Heung S. Choi, and Ming-Jyh Chern, Computational Simulations of Flow and Oxygen/Drug Delivery in a Three-Dimensional Capillary Network, Biomathematics, <http://dx.doi.org/10.1155/2014/359327>
43. Ampere A. Tseng, Miroslav Raudensky and Tae-Woo Lee (2015), "Liquid Sprays for Heat Transfer Enhancements: A Review", Heat Transfer Engineering", doi: .1080/01457632.2015.1136168.
44. T.-W. Lee (2015), "Non-Linear Series Inversion Method for Forecasting Canadian GDP", Business and Economics Journal, Vol. 6, Issue 3.

45. Hnizdil, M., Chabircovsky, M., Raudensky, M. Lee, T.-W., Heat Transfer during Spray Cooling of Flat Surfaces with Water at Large Reynolds Numbers, *Journal of Flow Control, Measurement & Visualization*, 4, pp. 104-113.
46. Lee, T.-W. and An, K. (2015), Recovering subgrid-scale features in turbulent flows through compressive sensing, *Journal of Flow Visualization and Image Processing*, 22 (4), pp. 1-13.
47. Lee, T.-W. and K. An, Quadratic formula for determining the drop size in pressure-atomized sprays with and without swirl, *Physics of Fluids*, 28, 063302 (2016); doi: 10.1063/1.4951666.
48. Mahon, K.S. and Lee, T.-W., Compaction of granular HMX: P- α porosity model in CTH hydrocode, *AIP Advances* 5, 127121 (2016); doi: 10.1063/1.4938524.
49. Lee, T.-W. and J.E. Park, Integral Formula for Determination of the Reynolds Stress in Canonical Flow Geometries, *Progress in Turbulence VII*, Springer Proceedings in Physics, Vol. 196, pp. 143-155, Springer-Verlag, 2017.
50. Lee, T.-W. (2018), Eulerian vs. Lagrangian analysis of the Reynolds stress, *Flow, Turbulence and Combustion*, submitted.

RESEARCH GRANTS

EXTERNAL GRANTS

National Science Foundation, Research Initiation Award; "Turbulent Partially Premixed Flames: Structure and Pollutant Emission Characteristics", 1994-1997.

Batelle Pacific Northwest National Laboratory/Department of Energy, Innovative Concepts Program; "Advanced Uniform Droplet Sprays for Aluminum Production and Processing", 1997-1998.

Allied Signal Engine Company, "Fuel-Air Mixing in Gas-Turbine Engine Combustors", 1997-1998.

National Science Foundation, "Dynamical Relationship between the Surface Properties and Propagation Speed of Turbulent Premixed Flames", 1997-2000.

National Science Foundation, "Fourier-Transform Infrared Spectrometer for Combustion Studies", with Co-PI R.E. Peck, 1997-1998.

Federal Aviation Administration/Boeing Aircraft Company, "Fuel Vapor Dynamics and Ignition in Enclosed Structures", (50 % PI with R.E. Peck and D.L. Laananen), 1998-2000.

SRI International, "Copper-Sulfur Deposits on Fuel Quantity Indicating System and Attendant Wiring" (25% Co-PI with R.E. Peck and D.L. Laananen), 1999-2000.

Salt River Project, "CFD Modeling of Scrubber Flows, Including Heat Exchangers", 2001-2002.

Salt River Project, "Development and Implementation of Water Level Measurement System", 2001-2002.

Salt River Project, "Water Surface Velocity Monitoring Using Microwave Doppler Radar", 2002-2003.

Salt River Project, "Sound Level and Frequency from SRP Power Plants: Monitoring, Analyses and Suppression Strategies" (75% PI with V. Wells), July 1, 2003 – June 30, 2004.

Salt River Project, "Flow and Temperature Characterization in Combustion Turbine Exhaust Duct and HRSG Superheater Section at Santan and Kyrene Plants Using CFD and Laboratory Testing" (with R. Roy), July 1, 2003 – June 30, 2004.

Salt River Project, "Implementation of Water Surface Velocity Sensor Using Microwave Doppler Radar", August 1, 2003 – July 31, 2004.

Salt River Project, “Stack Flow Characterization for Optimal Exhaust Monitoring: Effects of Load Conditions on Flow Uniformity”, July 1, 2004 – June 30, 2005.

Salt River Project, “Flow and Temperature Characterization in Combustion Turbine Exhaust Duct and HRSG Superheater Section at Santan and Kyrene Plants Using CFD and Laboratory Testing: Phase II”, (with R. Roy), July 1, 2004 – June 30, 2005.

Salt River Project, “Thermodynamic, Environmental, and Economic Analyses of Renewable Energy Technologies” (with R. Roy), July 1, 2005 – June 30, 2006.

Salt River Project, “Evaluation of the Ultrasound Monitoring of Water Flows in SRP Waterways”, July 1, 2004 – June 30, 2005.

Salt River Project, “System Analysis and Optimization of CGS Environmental Control”, July 1, 2004 – June 30, 2005.

Salt River Project, “System Analysis and Optimization of CGS Environmental Control: Phase II”, July 1, 2005 – June 30, 2006.

National Science Foundation, “Nanoparticle-Filled Liquid Fuels for Efficient Energy Conversion”, (20% Co-PI with P. Phelan, R. Peck, R. Prasher and R. Pacheco), September 1, 2006- August 31, 2007.

Salt River Project, “Three-Dimensional Simulations of Building Flow and Temperature at CGS”, July 1, 2006 – June 30, 2007.

Salt River Project, “Simulations of Internal Flow at Micro-Scale Generation Systems”, July 1, 2007 – June 30, 2008.

Salt River Project, “SOFC Fuel Cell System and Process Simulations”, July 1, 2008 – June 30, 2009.

Salt River Project, “SCR Reduction of Nitric Oxides in HRSG”, July 1, 2009 – June 30, 2010.

Salt River Project, “Development of an Imaging System for Remote Water Level Measurements with Custom-Built Processing and Data Archival”, July 1, 2009 – June 30, 2010.

Salt River Project, “SCR Reduction of Nitric Oxides in HRSG: Phase II”, July 1, 2010 – June 30, 2011.

Salt River Project, “Development of an Imaging System for Remote Water Level Measurements with Custom-Built Processing and Data Archival: Phase II”, July 1, 2010 – June 30, 2011.

Salt River Project, “Field Operational Issues and Data Integration for the Flowtography Imaging System: Remote Water Level Measurements with Custom-Built Processing and Data Archival”, July 1, 2011 – June 30, 2012.

Salt River Project, “To Spray or Not to Spray: Computational Fluid Dynamic Simulations of the SPRITS Spray Flow, Including the Water Droplet Trajectory, Evaporation and Impingement Analyses”, July 1, 2011 – June 30, 2012.

Salt River Project, “Assessment of Steam Turbine Efficiency in Kyrene7”, July 1, 2012 – June 30, 2013.

Salt River Project, “Analysis and Optimization of Santan SPRITS Spray Flow: Optimum Number, Type and Operation of Injectors”, July 1, 2013 – June 30, 2014.

Salt River Project, “Bartlett Dam Water Level Measurements: Temperature Correction and Comparison of Temperature Sensors for Future Permanent Installations”, July 1, 2014 – June 30, 2015.

Salt River Project, “Analysis of gravimetric data on groundwater levels and hydrological properties”, July 1, 2014 – June 30, 2015.

Salt River Project, “Reducing Pressure Oscillations (Waterhammer) in SPRITS Injection Lines, Including Comparison of Injectors”, July 1, 2014 – June 30, 2015.

INTERNAL GRANTS

Arizona State University, Research Incentive Award, "Flame Propagation in Droplet Arrays", 1993.

Arizona State University, Center of Innovation in Engineering Education, "Development and Evaluation Methods for Design Content in Propulsion Engineering Courses", 1998.

Arizona State University, College of Engineering and Applied Sciences, "Development of Apparatus for Fuel Vapor Ignition Studies", 1998.