



# John Abraham

## Professor & Chair

[Department of Mechanical Engineering](#)  
[San Diego State University](#)

5500 Campanile Drive  
San Diego, CA 92182-1323

Tel: (619) 594 2450

Fax: (619) 594-3599

Email: [jabraham@mail.sdsu.edu](mailto:jabraham@mail.sdsu.edu)

B. Tech. I. I. T., Kharagpur, 1981  
M. A. Princeton University, 1984  
Ph. D. Princeton University, 1986

Professor and Chair, Department of Mechanical Engineering, San Diego State University (current)  
Adjunct Professor, Department of Mechanical Engineering, Purdue University (current)  
Professor, School of Mechanical Engineering, Purdue University, affiliated faculty - Computational Science and Engineering Program (2002-2015)  
Visiting Professor, School of Mechanical Engineering, University of Adelaide, Australia (2013-2015)  
Professor, on leave from Purdue, School of Mechanical Engineering, University of Adelaide, Australia (2012-13)  
Faculty Sabbatical, Sandia National Laboratory, Livermore, CA (2008)  
Associate Professor, School of Mechanical Engineering, Purdue University (1996-2002)  
Richard and Barbara Nelson Assistant Professor, Mechanical Engineering, University of Minnesota (1993-1995)  
Member of Research Staff, Mechanical and Aerospace Engineering, Princeton University (1992-93)  
Visiting Research Collaborator, Mechanical and Aerospace Engineering, Princeton University (1989-91)  
Senior Engineer, John Deere Technologies International (1986-91)

---

## Professional Societies

American Physical Society  
Fellow of the American Society of Mechanical Engineers  
American Society of Engineering Education  
American Institute of Aeronautics and Astronautics (Senior Member)  
Institute of Liquid Atomization and Sprays  
Fellow of the Society of Automotive Engineers  
The Combustion Institute

## Editorial Responsibilities

Associate Editor, Combustion Science and Technology  
 Associate Editor, Journal of Fluids Engineering - Transactions of the ASME  
 Editorial Board, International Journal of Spray and Combustion Dynamics

## Current Research Interests

### Multiphase Flows

Sprays and atomization; interfacial instabilities; drop dynamics; phase transition ; particle transport; wall interactions.

### Combustion/Combustion Modeling

Computational studies of fundamental combustion phenomena. Modeling of transient, reacting, turbulent multiphase fluid flows in internal combustion engines. Turbulent reacting jets.

### Computational Fluid Dynamics

As applied to the areas listed above using DNS, LES, and RANS simulations. Computational methods for micro- and nano- fluidics using mesoscopic and microscopic approaches such as Lattice-Boltzmann Methods (LBM), Dissipative Particle Dynamics (DPD), and Molecular Dynamics (MD). Multiscale modeling. GPU computing.

## Ph.D. Graduates

Z. Wang	2016	ExxonMobil Research, Houston, TX
G. Cai(Adelaide)	2016	Fiat-Chrysler Corporation, MI
M. Ameen	2014	Argonne National Laboratory, IL
H. Reddy	2011	Intel, Hillsboro, OR
S. Mukhopadhyay	2011	Intel, Hillsboro, OR
R. Owston	2010	Southwest Research Institute, San Antonio, TX
R. Venugopal	2008	Cummins Engine Compansy, Columbus, IN
S. Mukherjee	2006	Atkins Global Consulting, Houston, TX
A. Tiwari	2006	ExxonMobil Research, Houston, TX
J. Anders	2006	Caterpillar, Inc., Peoria, IL
K.N. Premnath	2004	University of Colorado, Denver, CO
A.R. Wadhwa	2004	General Motors Research, Warren, MI
M.E. McCracken	2004	ExxonMobil Research, Houston, TX
L. Song	2003	Smith International, Inc., Houston, TX
V. Gopalakrishnan	2003	General Motors Research, Warren, MI
V.A. Iyer	2001	General Electric Aircraft Engines, Cincinnati, OH

S.L. Post	2001	Bradley University, Peoria, IL
L. Fang	2000	Honeywell, Inc., Phoenix, AZ

(L. Fang co-advised with Prof. Victor Goldschmidt)

## Recent Archival Journal Publications

Z. Wang, V. Magi, and J. Abraham, Turbulent Flame Speed Dependencies in Lean Methane-Air Mixtures under Engine Relevant Conditions, *Combustion and Flame*, 180:53-62, 2017;  
<http://doi.org/10.1016/j.combustflame.2017.02.023>

Z. Wang, M. Ameen, S. Som, and J. Abraham, Assessment of Large-Eddy Simulations of Turbulent Round Jets using Low-Order Numerical Schemes, *SAE International Journal of Commercial Vehicles*, 10(2), doi:10.4271/2017-01-0575, 2017.

G. Cai and J. Abraham, Multidimensional Simulations of Non-Reacting and Reacting Diesel and Biodiesel Sprays, *Energy*, 119:1221-1229, 2017.

Z. Wang, E. Motheau, and J. Abraham, Effects of Equivalence Ratio Variations on Turbulent Flame Speed in Lean Methane/Air Mixtures under Lean-Burn Natural Gas Engine Operating Conditions, *Proceeding of the Combustion Institute*, 36(3):3423-3430, 2017

L. Zhang, A. Jebakumar, and J. Abraham, Lattice Boltzmann Method Simulations of Stokes Number Effects on Particle Motion in a Channel Flow, *Phys. Fluids*, 28, 063306, 2016; <http://dx.doi.org/10.1063/1.4953800>.

A.S. Jebakumar and J. Abraham, Comparison of the Structure of Computed and Measured Particle-Laden Jets for a Wide Range of Stokes Numbers, *International J. Heat and Mass Transfer*, 97:779-786, 2016.

E. Motheau and J. Abraham, A High-Order Numerical Algorithm for DNS of Low-Mach-Number Reactive Flows with Detailed Chemistry and Quasi-Spectral Accuracy, *J. Computational Physics*, 313:430-454, 2016.

G.Cai, M.Yen, and J. Abraham, On Formulating a Simplified Soot Model for Diesel and Biodiesel Combustion, *Chemical Engineering Science*, 144:249-259, 2016.

A.S. Jebakumar, K.N. Premnath, and J. Abraham, Lattice Boltzmann method simulations of Stokes number effects on particle trajectories in a wall-bounded flow, *Computers and Fluids*, 124:208-219, 2016.

J. Zhang and J. Abraham, A Numerical Study of Laminar Flames Propagating in Stratified Mixtures, *Combustion and Flame*, 163:461-471, 2016.

M. Ameen and J. Abraham, Are "2D DNS" Results of Turbulent Fuel/Air Mixing Layers Useful for Assessing Subgrid-Scale Models?, *Numerical Heat Transfer, Part A: Applications*, 69 (1): 1-13, 2016.

M. Yen and J. Abraham, Soot and Nitric Oxide Modeling in Reacting Diesel Jets with an Unsteady Flamelet Progress Variable Model, *Proc. IMechE, Part D: J. Automobile Engineering*, 230(4):503-513, 2016.

M. Ameen, V. Magi, and J. Abraham, An Evaluation of the Assumptions of the Flamelet Model, *Chemical*

Engineering Science, 138:403-413, 2015.

J. Abraham, Critical Observations on the Modeling of Nonreacting and Reacting Diesel Sprays, Proceedings of the IMechE Part D: Journal of Automobile Engineering, 229(11):1543-1565, 2015.

M. Ameen and J. Abraham, A Priori Evaluation of Subgrid-Scale Combustion Models for Diesel Engine Applications, Fuel, 153:612-619, 2015.

M.Ameen and J. Abraham, Evaluation of Scalar Dissipation Rate Sub-Models for Modeling Unsteady Reacting Jets in Engines, Chemical Engineering Science, 127:334-343, 2015.

Z. Wang and J. Abraham, Fundamental Physics of Flame Development in Autoigniting Dual Fuel Mixtures, Proceedings of the Combustion Institute, 35(1):1041-1048, 2015.

Z. F. Tian and J. Abraham, Application of Computational Fluid Dynamics (CFD) in Teaching Internal Combustion Engines, International Journal of Mechanical Engineering Education, 42(1):73-83, 2014.

M. Ameen and J. Abraham, RANS and LES Study of Lift-Off Physics in Reacting Diesel Jets, SAE Paper 2014-01-1118.

M. Yen and J. Abraham, Computations of Soot and NO in Lifted Flames under Diesel Conditions, SAE Paper 2014-01-1128.

C. Bajaj, M. Ameen, and J. Abraham, Evaluation of an Unsteady Flamelet Progress Variable Model for Autoignition and Flame Lift-Off in Diesel Jets, Combustion Science and Technology, 185:454-472, 2013.

S. Mukhopadhyay and J. Abraham, Influence of Turbulence on Autoignition in Stratified Mixtures Under Compression Ignition Engine Conditions, Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering, 227:133-145, 2013.

H. Reddy and J. Abraham, Influence of Turbulence-Kernel Interactions on Flame Development in Lean Methane/Air Mixtures Under Natural Gas-Fueled Engine Conditions, Fuel, 103:1090-1105, 2013.

H. Reddy and J. Abraham, Two-Dimensional Direct Numerical Simulation Evaluation of the Flame Surface Density Model for Flames Developing from an Ignition Kernel in Lean Methane/Air Mixtures Under Engine Conditions, Physics of Fluids, 105:108, 2012.

S. Mukhopadhyay and J. Abraham, Influence of Heat Release and Turbulence on Scalar Dissipation Rate in Autoigniting n-Heptane/Air Mixtures, Combustion and Flame, 159(9):2883-2895, 2012.

H. Reddy and J. Abraham, Transient Evolution of Strain and Curvature in Flames Developing from Kernels, International Journal of Spray and Combustion Dynamics, 4 (4):323-340, 2012.

S. Mukhopadhyay and J. Abraham, Evaluation of an Unsteady Flamelet Progress Variable Model for Autoignition and Flame Development in Compositionally Stratified Mixtures, Physics of Fluids, 075115, 2012.

C.S. Bhat, P. Meckl, J.S. Bolton, and J. Abraham, Influence of Fuel Injection Parameters on Combustion-Induced Noise in a Small Diesel Engine, International Journal of Engine Research, 13(2):130-146, 2012.

C. Bajaj, J. Abraham, and L.M. Pickett, Vaporization Effects on Transient Diesel Spray Structure, Atomization and Sprays, 21(5):411-426, 2011.

J. Abraham, Computational Study of Charge Stratification in Early-Injection SCCI Engines under Light-Load Conditions, International Journal of Automotive Technology, 12(5):721-732, 2011.

- S. Mukhopadhyay and J. Abraham, Influence of Compositional Stratification on Autoignition in n-Heptane/Air Mixtures, *Combustion and Flame*, 158(6):1064-1075, 2011.
- H. Reddy and J. Abraham, A Numerical Study of Vortex Interactions with Flames Developing from Ignition Kernels in Lean Methane/Air Mixtures, *Combustion and Flame*, 158(3):401-415, 2011.
- R. Owston and J. Abraham, Exploratory Studies of Modeling Approaches for Hydrogen Triple Flames, *International Journal of Hydrogen Energy*, 36(14):8570-8582, 2011.
- M. Sayeed, V. Magi, and J. Abraham, On the Efficiency of a High-Performance Parallel Solver for Turbulent Reacting Flow Simulations, *Numerical Methods in Heat Transfer, Part B*, 59(3):169-189, 2011.
- H. Reddy and J. Abraham, Ignition Kernel Development Studies Relevant to Lean-Burn Natural Gas Engines, *Fuel*, 89(11):3262-3271, 2010.
- R. Owston, V. Magi, and J. Abraham, Some Numerical Considerations in the Simulation of Low-Ma Number Hydrogen/Air Mixing Layers, *International Journal of Hydrogen Energy*, 35(23): 12936-12944, 2010.
- R. Venugopal and J. Abraham, Numerical Studies of the Response of Flamelets to Unsteadiness in the Near-Field of Jets Under Diesel Conditions, *Combustion Science and Technology*, 182(7):717-738, 2010.
- J. Abraham and L.M. Pickett, Computed and Measured Fuel Vapor Distribution in a Fuel Spray, *Atomization and Sprays*, 20(3): 241-250, 2010.
- R. Owston and J. Abraham, Structure of Hydrogen Triple Flames and Premixed Flames Compared, *Combustion and Flame*, 157:1552-1565, 2010.
- R. Owston and J. Abraham, Numerical Study of Hydrogen Triple Flame Response to Mixture Stratification, Ambient Temperature, Pressure, and Water Vapor Concentration, *International Journal of Hydrogen Energy*, 35(10):4723-4735, 2010.
- R. Owston and J. Abraham, Flame Propagation in Stratified Hydrogen-Air Mixtures: Spark Placement Effects, *International Journal of Hydrogen Energy*, 34(15):6532-6544, 2009.
- R. Venugopal and J. Abraham, Numerical Studies of Vortex-Induced Extinction/Reignition Relevant to the Near-Field of High-Reynolds Number Jets, *Physics of Fluids*, 21, 055106, 2009.
- R. Venugopal and J. Abraham, Unsteady Flamelet Response in the Near Field of High-Reynolds-Number Jets, *AIAA Journal*, 47(6):1491-1506, 2009.
- H. Reddy and J. Abraham, Dissipative-Particle Dynamics Simulations of Flow over a Stationary Sphere in Compliant Channels, *Physics of Fluids*, 21, 053303, 2009.
- S. Mukhopadhyay and J. Abraham, A particle-based multiscale model for submicron fluid flows, *Physics of Fluids*, 21, 027102, 2009. Also in March 9, 2009 issue of *Virtual Journal of Nanoscale Science and Technology*.
- S.R. Hoffman and J. Abraham, A Comparative Study of n-Heptane, Methyl Decanoate, and Dimethyl Ether Combustion Characteristics Under Homogeneous-Charge Compression-Ignition Engine Conditions, *Fuel*, 88:1099-1108, 2009.
- A. Tiwari and J. Abraham, A Two-Component Two-Phase Dissipative Particle Dynamics Model, *International Journal of Numerical Methods in Fluids*, 59(5):519-533, 2009.

R. Venugopal and J. Abraham, Numerical Investigations of Reignition in Vortex-Perturbed n-Heptane Nonpremixed Flames, *AIAA Journal*, 46(10):2479-2497, 2008.

J. Anders, V. Magi, and J. Abraham, A Computational Investigation of the Interaction of Pulses in Two-Pulse Jets, *Numerical Heat Transfer, Part A: Applications*, 54(11):999-1021, 2008.

A. Tiwari, H. Reddy, S. Mukhopadhyay, and J. Abraham, Simulations of Liquid Nanocylinder Breakup with Dissipative Particle Dynamics, *Physical Review E* 78, 016305, 2008.

J.W. Anders, R. Venugopal, V. Magi, and J. Abraham, A Study of Flame-Vortex Interactions in the Presence of Residual Gases, *Combustion Science and Technology*, 180(7), 1395-1420, 2008.

R. Venugopal and J. Abraham, A 2-D DNS Investigation of Extinction and Reignition Dynamics in Nonpremixed Flame-Vortex Interactions, *Combustion and Flame*, 153(3), 442-464, 2008.

A. Tiwari and J. Abraham, Dissipative Particle Dynamics Simulations of Liquid Nanojet Breakup, *Microfluidics and Nanofluidics*, 4(3), 227-235, 2008.

N. Kumari and J. Abraham, Interactions of Decelerating Drops Moving in Tandem, *Atomization and Sprays*, 18:191-241, 2008.

R. Owston, V. Magi, and J. Abraham, Fuel-Air Mixing Characteristics of DI Hydrogen Jets, *SAE International Journal of Engines*, 1(1):693-712, 2008.

A.R. Wadhwa, V. Magi, and J. Abraham, Transient Deformation and Drag of Decelerating Drops in Axisymmetric Flows, *Physics of Fluids*, 19, 113301, 2007.

R. Venugopal and J. Abraham, A Numerical Investigation of Flame Lift-off in Diesel Jets, *Combustion Science and Technology*, 179:2599-2618, 2007.

J.W. Anders, V. Magi, and J. Abraham, Large-eddy simulation in the near field of a transient multicomponent gas jet with density gradients, *Computers and Fluids*, 36:1609-1620, 2007.

S. Mukherjee and J. Abraham, Crown Behavior in Drop Impact on Wet Walls, *Physics of Fluids*, 19, 052103, 2007.

R. Owston, V. Magi, and J. Abraham, Interactions of Hydrogen Flames with Walls: Influence of Wall Temperature, Pressure, Equivalence Ratio, and Diluents, *International Journal of Hydrogen Energy*, 32:2094-2104, 2007.

S. Mukherjee and J. Abraham, Investigations of Drop Impact on Dry Walls with a Lattice-Boltzmann Model, *Journal of Colloid and Interface Science*, 312:341-354, 2007.

R. Venugopal and J. Abraham, A Review of Fundamental Studies Relevant to Flame Lift-off in Diesel Jets," *SAE Paper 2007-01-0134*, *SAE Transactions, Journal of Engines*, 116:132-151, 2007.

R. Owston, V. Magi, and J. Abraham, Wall Interactions of Hydrogen Flames Compared with Hydrocarbon Flames, *SAE Paper 2007-01-1466*, *SAE Transactions, Journal of Engines*, 116:993-1002, 2007.

K. N. Premnath and J. Abraham, Three-dimensional Multi-Relaxation Time (MRT) Lattice-Boltzmann Models for Multiphase Flow, *Journal of Computational Physics*, 224(2):539-559, 2007.

S. Mukherjee and J. Abraham, A Pressure-Evolution-Based Multi-Relaxation-Time High-Density-Ratio Two-Phase Lattice-Boltzmann Model, *Computers and Fluids*, 36:1149-1158, 2007.

- S. Mukherjee and J. Abraham, Lattice Boltzmann Simulation of Two-Phase Flow with High Density Ratio in Axially Symmetric Geometry, *Physical Review E* 75, 026701, 2007. Also in *Virtual Journal of Nanoscale Science and Technology*, 15(7), February 19, 2007.
- R. Owston, V. Magi, and J. Abraham, A Numerical Study of Thermal and Chemical Effects in Interactions of n-Heptane Flames with a Single Surface, *Combustion and Flame*, 148:127-147, 2007.
- A. Tiwari and J. Abraham, Dissipative-Particle-Dynamics Model for Two-Phase Flows, *Physical Review E* 74, 056701, 2006. Also in *Virtual Journal of Nanoscale Science and Technology*, 14(20), November 13, 2006.
- K. Premnath, M. McCracken and J. Abraham, A Review of Lattice Boltzmann Methods for Multiphase Flows Relevant to Engine Sprays, *SAE Transactions*, 113:929-940, 2006.
- K. Premnath and J. Abraham, Simulations of Binary Drop Collisions with a Multiple-Relaxation-Time Lattice-Boltzmann Model, *Physics of Fluids*, 17, 122105, 2005.
- M. McCracken and J. Abraham, Simulation of Liquid Break-up with an Axisymmetric, Multiple-Relaxation-Time, Index-Function Lattice-Boltzmann Model, *Int. J. Modern Physics C*, 16(11), 1671-1692, 2005.
- A.R. Wadhwa, V. Magi and J. Abraham, Hybrid Compressible- Incompressible Numerical Method for Transient Drop-Gas Flows, *AIAA Journal*, 43(9):1974-1983, 2005.
- K. Premnath and J. Abraham, Lattice Boltzmann Model for Axisymmetric Multiphase Flows, *Physical Review E* 71, 056706, 2005.
- M. McCracken and J. Abraham, Simulations of Gas-Gas Mixing Layers with Lattice-Boltzmann Binary Fluid Model, *Int. J. Modern Physics C*, 16(4), 533-548, (2005).
- V. Iyer and J. Abraham, Two-Fluid Modeling of Spray Penetration and Dispersion Under Diesel Conditions, *Atomization and Sprays*, 15(3), 249-270, 2005.
- K. Premnath and J. Abraham, Lattice-Boltzmann Simulations of Drop-Drop Interactions in Two-Phase Flows, *Int. J. Modern Physics C*, 16(1): 25-44, 2005.
- M. McCracken and J. Abraham, Multiple-Relaxation-Time Lattice- Boltzmann Model for Multiphase Flow, *Physical Review E* 71, 036701, 2005.
- M. McCracken and J. Abraham, Lattice-Boltzmann Methods for Binary Mixtures with Different Molecular Weights, *Physical Review E* 71, 046704, 2005.
- K. Premnath and J. Abraham, Discrete Lattice BGK Boltzmann Equation Computations of Transient Incompressible Turbulent Jets, *Int. J. Modern Physics C*, 15(5):699-719, 2004.
- V. Gopalakrishnan and J. Abraham, Computed NO and Soot Distribution in Turbulent Transient Jets Under Diesel Conditions, *Combustion Science and Technology*, 176:603-641, 2004.
- V. Gopalakrishnan and J. Abraham, Effects of Multicomponent Diffusion on Predicted Ignition Characteristics of a N-Heptane Diffusion Flame, *Combustion and Flame*, 136:557-566, 2004.
- L. Song and J. Abraham, The Structure of Wall-Impinging Jets: Computed Versus Theoretical and Measured Results, *Journal of Fluids Engineering*, 125: 997-1005, 2003.
- V. Iyer and J. Abraham, An Evaluation of a Two-Fluid Eulerian-Liquid Eulerian-Gas Model for Diesel Sprays,

Journal of Fluids Engineering, 125: 660-669, 2003.