Krithika Narayanaswamy

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ACADEMIC APPOINTMENT

Assistant Professor,
Department of Mechanical Engineering,
Indian Institute of Technology Madras,
Chennai 600036,
India

EDUCATION

Stanford University **September 2008 – December 2013**

- *Doctor of Philosophy*, Mechanical Engineering
- *Doctor of Philosophy Minor*, Aerospace Engineering
- *Master of Science*, Mechanical Engineering

Indian Institute of Technology Madras **2004 – 2008**

- *Bachelor of Technology*, Mechanical Engineering

RESEARCH INTERESTS

Combustion, Chemical kinetics, Reduced order modeling

RESEARCH EXPERIENCE

Cornell University **2014 – May 2015**

Post-doctoral associate, Sibley school of Mechanical and Aerospace Engineering

Working with Dr. Perrine Pepiot, on

- **Analyzing multi-component fuel effects in flames using simulations:** *Current research project*
  Triple flames play an important role in the stabilization of lifted jet flames and thereby influence their lift-off height. In this study, a 2D laminar triple flame burning jet fuel is simulated using finite rate chemistry and detailed transport of species. The jet fuel is represented by using a surrogate mixture, comprised of *n*-dodecane, methylcyclohexane, and *m*-xylene. The chemical kinetics of this multi-component surrogate are described using a reduced model derived from a well-validated detailed mechanism. The heat release profiles of the lean and rich branches of the triple flame are compared to their unstretched 1D counterparts to identify similarities. Individual contribution of fuel components towards radicals are quantified using importance coefficients based on analysis of chemical network.

Stanford University **2008 – 2013**

Research Assistant, Flow Physics and Computational Engineering

Worked with Dr. Heinz Pitsch, on

- **Proposing gas-phase surrogates for jet fuels**
  Surrogates are often used to represent real fuels in combustion simulations. They are defined in a way as to mimic certain target properties of the real fuel. For gas phase combustion applications, typical targets are: (a) H/C ratio for overall heating value and burning rate, (b) cetane number for ignition characteristics, (c) molecular weight, (d) average molecular formula, and (e) Threshold Sooting Index (TSI) to quantify sooting tendency. In this study, surrogates were defined for jet fuels and Fischer-Tropsch fuels following a *constrained optimization* approach by minimizing the difference between the real fuel properties and those of the surrogate mixture.
- **Formulating a consistent mechanism for oxidation of surrogate components**
  In this study, building on top of a base mechanism for small hydrocarbons, a consistent kinetic model was developed to describe the oxidation of substituted aromatics, *n*-dodecane, and methylcyclohexane, which are important components of transportation fuel surrogates. An extensive validation for the individual fuel components was performed against several recent experimental data sets. The reaction model maintains a compact size and is hence amenable to chemical kinetic analysis. The ability to predict oxidation at low through high temperatures for *n*-dodecane and methylcyclohexane is another highlight of this reaction scheme. Further, the well-validated aromatic chemistry and pathways for formation of aromatics from methylcyclohexane oxidation enable the present reaction mechanism to be apt for assessing the formation of pollutants.

Indian Institute of Technology Madras **2007**
Bachelor's Project
Worked with Prof. K. Srinivasan, Department of Mechanical Engineering, and Prof. N. R. Panchapakesan, Department of Aerospace Engineering, on
Aerodynamics of flow around rectangular cylinders.

TVS Motors, Hosur, India **2006**
Summer Internship
An analytical model for a mono-tube hydraulic shock absorber damper

Indian Institute of Science, Bangalore **2005**
Summer Research Fellowship program
Worked with Prof. Jaywant H. Arakeri, Department of Mechanical Engineering,
Experiments to study natural convection in a tall vertical pipe

Indian Institute of Technology Madras **2005**
Junior Year Project
Worked with Prof. Venkatarathnam, Department of Mechanical Engineering,
Enabled virtual instrumentation using LabVIEW as a software tool

Teaching Experience

Stanford University **2012**
Teaching Assistant for "ME351A: Fluid Mechanics", Course instructor: Prof. Lester Su
Responsibilities:
- Held office hours and graded assignment sheets
- Assigned problems for the assignments and exams

Honors and Awards

- Merit certificate awarded by the Central Board of Secondary Education (CBSE) for class XII examination for Chemistry and Mathematics, 2004.
- Selected among top 10% in the National Standard Examination in Physics conducted by the Indian Association of Physics Teachers, 2003
- One among 750 students from a pool of about $350,000$ students to be awarded National Talent Search Examination Scholarship by the Central Government of India, 2000

Referees

- **Prof. Heinz Pitsch**
  Institut für Technische Verbrennung
  RWTH Aachen University
  Templergraben 64
  D-52056 Aachen, Germany
  h.pitsch@itv.rwth-aachen.de
- **Prof. Perrine Pepiot**
  256 Upson Hall
  Sibley School of Mechanical and Aerospace Engineering
  Cornell University
  Ithaca, New York - 14853, USA
  pp427@cornell.edu
- **Prof. Lester Su**
  440 Escondido Mall
  Stanford, California - 94305
  lester.su@stanford.edu