The Department of Mechanical Engineering presents:

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Bourns Hall A265

Mathematical Model of an Edge Flame in a Microcombustor

Abstract

This work considers non-premixed microcombustion in a narrow channel. Microcombustion devices have many practical applications, from micropropulsion and power generation to heat generation. Experimental results have shown that combustion can take place in dimensions smaller than the previously determined quenching limit; however, the flames sustained in these confined spaces exhibit many dynamics that are not well understood. For example, extinction reignition patterns appear along the length of the channel and flames oscillate parallel to the flow. This work considers a theoretical two dimensional microcombustor model, in which the fuel and oxidizer are initially separated. After entering the channel, the fuel and oxidizer are allowed to mix as they flow downstream. If ignition is successful, a tribrachial flame is sustained. This flame consists of a premixed leading edge and a trailing diffusion flame. The model leads to a nonlinear system of partial differential equations that are solved numerically. The current work investigates the effects of channel width, heat loss through the walls, and stoichiometry on the edge flame in a narrow channel.

Biography

Joanna attended Northwestern University where she received a Ph.D in Engineering Science and Applied Mathematics. Her research is in the area of mathematical modeling and numerical analysis with a focus in combustion and bioeconomics. She started working at the University of Redlands in 2009. In 2011, she won the outstanding teaching award for her work in teaching and developing applied mathematics classes. Since being at the University of Redlands, she has supervised multiple undergraduate research projects and developed the Math Modeling and Simulation Lab. Her most recent work has been published in Combustion Theory and Modeling; a full list of publications can be found on her website, http://bulldog2.redlands.edu/fac/joanna_bieri/index.html