College of Engineering
Department of
Mechanical & Industrial Engineering

The Sidney E. Fuchs Seminar Series

3:00-4:00pm, Friday, November 17, 2017
1100 Patrick F Taylor Auditorium

In the Search of Gain: A Journey into Pressure Gain Combustion in Rotating Detonation Engines

by Mirko Gamba *

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Although the concept of using a rotating detonation wave in an enclosed (annular) chamber as a means of effective combustion dates back to the 1960's, its use in rotating detonation engines (RDEs) has gained much attention only in recent years because of the thermodynamic benefits it offers in propulsion and power generation systems. The benefit offered by an RDE over conventional constant pressure combustion in traditional systems arises from the fact that chemical energy release occurs at nearly constant volume in a small region across a detonation wave, rather than in a deflagrating region. Unlike a traditional deflagration-based combustor where a pressure loss up to 5-8% can be experienced, the constant volume combustion provides an effective compression of the post-combustion gases over that provided by the compression stage. It is this additional compression that results in what is referred to as pressure gain, which ultimately translates into increased amount of work extracted from the turbine, making an RDE a pressure gain combustion (PGC) device. In this talk we will give an overview of recent activities on the study of RDEs at U-M. Specifically, we will discuss an experimental work aimed at investigating the operation and performance characteristics of an RDE operated with different fuel injection schemes and operating conditions. We will focus our attention to one specific configuration, and we will investigate the characteristics and dynamics of the detonating flowfield in an RDE in an attempt to understand its operation and quantify whether the device can actually produce pressure gain under realistic and practical configurations.

* Mirko Gamba is an Assistant Professor at the University of Michigan, Department of Aerospace Engineering. His expertise and interests include laser diagnostics for fluids and reacting flows, low- and high-speed mixing and combustion. His research has focused on experimental investigation of supersonic combustion phenomena in scramjet-type environments; shock train and isolator flows; rocket combustion; detonating flows with application to rotating detonation engines; hypersonic impulse facilities; development and application of various absorption and planar laser-induced fluorescence techniques for temperature, speciation and mixing measurements in supersonic flows; and turbulent nonpremixed combustion .