ABSTRACT

Unsteady flow oscillations in combustion devices, commonly known as combustion instabilities, were discovered in rocket and air-breathing engines at about the same time in the late 1930s. Since then, combustion instabilities have occurred in most, if not practically all, new development programs. Indeed, because of the high density of energy release in a volume having relatively low losses, conditions normally favor excitation and sustenance of flow oscillations in any combustion chamber intended for a propulsion system.

This lecture will provide an overview of combustion instabilities in four different types of propulsion systems (i.e., solid-rocket, liquid-rocket, gas-turbine, and ramjet/scramjet engines). Emphasis will be placed on the state-of-the-art understanding and research needs and challenges. Various research issues in acoustics, fluid mechanics, and chemistry related to oscillatory combustion in practical systems will be discussed. Both passive and active control techniques will be covered. Applications of contemporary numerical schemes, approximate analytical methods, and experimental diagnostic tools to combustion instability studies will be addressed.

BIO

Vigor Yang is the Williams R. T. Oakes Professor and Chair of the School of Aerospace Engineering at Georgia Institute of Technology. Prior to joining Georgia Tech in 2009, he was the John L. and Genevieve H. McCain Chair in Engineering at The Pennsylvania State University. Dr. Yang received his Ph.D. from the California Institute of Technology. He was the recipient of the AIAA Air-Breathing Propulsion Award (2005), the Pendray Aerospace Literature Award (2008), and the Propellants and Combustion Award (2009). He was the Editor-in-Chief of the AIAA Journal of Propulsion and Power during 2001-2009. He is currently the Editor-in-Chief of the JANNAF Journal of Propulsion and Energetics (2009-) and an editor of the Aerospace Book Series published by the Cambridge University Press. He is a fellow of AIAA and ASME.