Heat Transfer Studies for Gas Turbine Combustors

Dr. Srinath V. Ekkad
Professor and Department Head,
Mechanical and Aerospace Engineering
North Carolina State University

Friday, November 1, 2019
11:00 am, ECSS 2412

Abstract
Modern gas turbine combustors implement lean premixed (LPM) combustion system to reduce the formation of NOx pollutants. LPM technology has advanced to have the ability to produce extremely low level of NOx emissions. The current focus of research on LPM is focused on reducing the NOx emission to much smaller scales, which is mandated because of the stricter regulations and environmental concerns. Design improvements of gas turbine combustors for higher efficiency, reduced pollutant emissions, safety and durability require better understanding of combustion in swirl flows and thermal energy transfer from the turbulent reacting flows to solid surfaces. The study of flow fields and heat transfer characteristics inside a gas turbine combustor provides one of the most serious challenges for gas turbine researchers because of the harsh environment at high temperatures. Therefore, accurate measurement and prediction of the flows and heat loads are indispensable. This study presents wall heat flux measurements and flow details for reacting flow conditions in a model gas turbine combustor. Detailed flow measurement using PIV and heat transfer measurements using infrared thermography are presented for a variety of conditions and parameters to assess combustion performance. For example, fuel blends of 35%/60% to 55%/35% of CH4/CO2 are typically seen in Landfill gases. Additional focus is on studying the heat transfer and flow effects caused by burning unique fuel blends.

Biography
Dr. S. V. Ekkad is the Department Head and R.J Reynolds Professor in the Mechanical & Aerospace Engineering Department at North Carolina State University since September 2017. He previously served as the Associate Vice President for Research Programs at Virginia Tech. He also held the title of Rolls-Royce Commonwealth Professor for Aerospace Propulsion Systems at Virginia Tech. He was also the Founder and Director of the Rolls-Royce University Technology Center for Advanced System Diagnostics at Virginia Tech, one of 30 centers around the world, prior to joining NC State. He was in the Mechanical Engineering department at Virginia Tech from August 2007 to September 2017 after 8 years at LSU and 2 years at Rolls-Royce Allison Engine Company in Indianapolis. He received his Ph.D. from Texas A&M University and M.S. from Arizona State University. He has over 25 years of experience in heat transfer related research. He has published over 250 journal & conference articles, three patents and co-authored a book and three book chapters. He currently has funding from Solar Turbines, and Triebis Systems/Chromalloy. He has been working on gas turbine cooling and heat transfer issues since 1989 including a stint as a design engineer at Rolls-Royce, Indianapolis before his academic career. Dr. Ekkad has also served as a summer faculty fellow at AFRL, Dayton in 2003. He is well known for his contributions to heat transfer experimental methods. In 2004, he received the inaugural ASME Bergles/Rohsenow Young Investigator in Heat Transfer Award for significant contributions to the field of heat transfer by a researcher under the age of 36. He is also the Editor-in-Chief for the ASME Journal for Thermal Science and Engineering Applications.