EVOLUTION OF TUNABLE LASER ABSORPTION SENSORS FOR COMBUSTION AND PROPULSION

Thursday, February 22, 2018 | 4:00 p.m. | 202 Reed McDonald

Abstract

Wavelength-tunable, narrow-linewidth continuous-wave (CW) lasers offer unique opportunities for spectrally resolved, line-of-sight absorption spectroscopy with many applications in fundamental science and engineering practice. The availability of these laser sources has continued to improve from their early beginning nearly fifty years ago, with particularly important progress in recent years to extend the available wavelength range into the mid-infrared where many species of interest to propulsion and combustion have strong absorption features. A key virtue of spectrally resolved absorption is that enables in situ measurements of multiple gas dynamic properties of interest, including temperature, pressure, velocity and species, often simultaneously, as well as derived quantities such as mass or momentum flux. In their simplest form, measurement strategies are based on either wavelength-scanned direct absorption or fixed-wavelength absorption, the latter being capable of high temporal resolution. More sensitive strategies are also available, including wavelength modulation with harmonic detection and cavity-enhanced absorption. This presentation will trace the evolution of tunable laser absorption spectroscopy (TLAS) as a diagnostic concept over the past forty years, with examples drawn from diverse combustion and propulsion environments representing a wide range of flow parameters.

Professor Hanson received his doctoral degree from Stanford University in Aeronautics and Astronautics. He currently holds the Woodard Chair of Mechanical Engineering at Stanford. His research is concerned with laser diagnostics and sensors, spectroscopy, shock-wave physics and combustion chemistry. He is a Fellow of AIAA, ASME and OSA, a member of the National Academy of Engineering, and a recipient of gold medal awards from the Combustion Institute, the Institute for Dynamics of Explosions and Reactive Systems, and the AIAA. He has published over 1100 papers and advised over 100 doctoral students, including 31 now holding faculty appointments.

Ronald K. Hanson, Ph.D.
Woodard Chair of Mechanical Engineering
Stanford University

Refreshments served at 3:45 p.m.