Institute Lecture

Prediction and control of combustion instabilities in gas turbines for propulsion and power generation

Dr. Thierry Poinsot, Research Director,
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13th May 2016, Time: 5.00 PM, Venue: L-15

Abstract

This talk presents recent progress in the field of thermoacoustic combustion instabilities in propulsion engines such as rockets or gas turbines. Combustion instabilities have been studied for more than a century in simple laminar configurations as well as in laboratory-scale turbulent flames. These instabilities are also encountered in real engines but new mechanisms appear in these systems because of obvious differences with academic burners: larger Reynolds numbers, higher pressures and power densities, multiple inlet systems, complex fuels. Other differences are more subtle: real engines often feature specific unstable modes such as azimuthal instabilities in gas turbines or transverse modes in rocket chambers. Hydrodynamic instability modes can also differ as well as the combustion regimes, which can require very different simulation models. The integration of chambers in real engines implies that compressor and turbine impedances control instabilities directly so that the determination of the impedances of turbomachinery elements becomes a key issue. Gathering experimental data on combustion instabilities is difficult in real engines and Large Eddy Simulation (LES) has become a major tool in this field. Recent examples, however, show that LES is not sufficient and that theory, even in these complex systems, plays a major role to understand both experimental and LES results and to identify mitigation techniques.

About the speaker

Prof. Thierry Poinsot is the research director at Institut de Mécanique des Fluides de Toulouse (IMFT), CNRS, France. His research interests include theory, simulations and experiments on laminar and turbulent combustion, combustion instabilities, simulation and control of two-phase flows, and passive and active control methods for flow and combustion instabilities. He founded the computational fluid dynamics (CFD) group at CERFACS (Centre for Research and Formation for Advanced Scientific Computations). At present, he is leading a group of 65 researchers, which includes 14 senior scientists and 35 PhD students. He also holds several key positions, which includes the senior research scientist at the Centre for Turbulence Research, Stanford University and NASA Ames, consultant for French Institute of Petroleum Energies Nouvelles, Air Liquide, Siemens, Daimler, and an invited professor in French engineering schools and at several prestigious foreign universities. He also leads the European Research Council advanced grant ‘INTECOCIS’ on combustion instability simulations on massively parallel systems. He has supervised 65 PhD theses, 20 post doctoral works and 100 Master theses. He published more than 180 articles in reputed journals and owns a number of patents on the control of combustion instabilities. He also co-authored a textbook on combustion titled “Theoretical and numerical combustion”. In the year of 2003, he became the associate fellow of AIAA. Currently, he is the associate editor of the journal Combustion and Flame. His courses on CFD, numerical combustion and theoretical combustion received are very popular both in the academic industries and industries.

Tea at 4:45 PM

All interested are welcome.

Amalendu Chandra
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