Short Course Sponsored by GIAN MHRD, GOI

On

Course on ULTRA CLEAN AND LOW PULSATION GAS TURBINES

November 3rd to 7th 2019, at IIT Indore

Overview

Reduction of CO_2 emissions is of primary concern in power generation. This requires more efficient gas turbine cycles. Increase in efficiency can be achieved by higher combustor pressure and higher turbine inlet temperatures or by completely new concepts. All of these efficiency augmentation strategies require novel combustor technologies allowing ultra-low emissions, fuel flexibility, and stable operation over a wide operational range.

The course will start with an overview on modern gas turbine technology. With this knowledge we will explore novel, highly efficient gas turbine cycles. An additional challenge for combustion-based systems is keeping NOx emissions under control. Combustion with low NOx emission is often associated with the problem of high pulsation amplitude combustion instabilities, which are detrimental to the gas turbine and shrinks its operational range. We will first introduce methods to achieve ultra-low NOx emissions and subsequently discuss the origin of these instabilities, governing mechanisms, simple models to describe them, and how to suppress their occurrence. We will present methods for fast and efficient fuel-air mixing, combustors for ultra-wet (heavily reduced NOx) cycles and next-generation constant volume combustors for gas turbines. The primary objectives of the course are as follows:

i) Leading the participants to understanding the principles of clean gas turbine technology,
ii) Sharpening the engineering background for more efficient power generation cycles,
iii) Providing concepts for sustainable energy generation,
iv) Building in capability amongst the participants in the design of ultra-low emission technologies,
v) Providing exposure to combustion instabilities, their modeling and damping methods, enhancing the capability to model thermoacoustic problems and to develop mitigation measures.

Modules	**Day 1:** The clean power challenge, gas turbine processes, *lecture* **Day 2:** New gas turbine cycles, ultra-wet cycles, constant volume combustors, *lecture: 2 hrs* Basics of combustion dynamic with examples, *tutorial: 2 hrs* **Day 3:** Ultra clean combustors and the occurrence of combustion dynamics, *lecture: 2 hrs* Simulation of combustion instabilities session with examples, *tutorial: 2 hrs* **Day 4:** Combustor dynamics in gas turbines and how they were solved, *lecture: 2 hrs* Practical examples on how to characterize the burner behavior, *tutorial: 3 hrs* **Day 5:** Ultra-low emission and pulsation combustion systems, *lecture: 2 hrs* Suppression of combustion instabilities, *tutorial: 3 hrs*
You Should Attend If…	• Engineers, scientist and researchers from private and government organizations incl. R&D laboratories allied to mechanical, aerospace, chemical engineering, manufacturing & energy. • Undergraduates, M.E/ M.Tech./M.Sc. and Ph.D. engineering students and faculty in mechanical, aerospace, chemical, manufacturing, production, and energy.
Fees	UG, PG students & Research Scholars: INR 3000/- Faculty Members: INR 6000/- Foreigners: USD 300/- Industry and Others: INR 10000/-
Accommodation	Paid accommodation will be provided to participants on first-come-first-serve basis.

The Faculty

Foreign Expert: Professor Christian Oliver Paschereit

Prof. Dr. Christian Oliver Paschereit is heading the Chair of Fluid Dynamics, Hermann-Föttinger-Institut, TU Berlin since 2003. His research and teaching cover a broad spectrum of topics related to fluid mechanics and combustion technology: flow and combustion control, vessel aerodynamics, gas turbine technology, ultra-low NOx combustion, thermoacoustics, pressure gain combustion and wind turbine technology. Before moving to TU Berlin, Oliver Paschereit held an upper management position at ABB / ALSTOM in Switzerland which he joined in 1994. From 1992 – 1994 he worked on high-speed train acoustics and helped to substantially reduce train noise. After his studies at TU Berlin and Ecole Centrale de Lyon he obtained his PhD from TU Berlin and the University of Arizona. His work in industry on clean, efficient and reliable gas turbines had major impact during the commissioning of several new gas turbine families. The developed methods and technologies paved the way for ultra-low emission gas turbine systems and are to a large extent the state-of-the-art in modern power generation technology. Together with his research group he is presently developing future technologies like ultra-wet gas turbine cycles and the integration of constant volume combustion into gas turbines. His research activities on fluid dynamics have had an impact on efficient trucks, cars and trains; wind turbines; and were used even in the America's Cup (sailing). Research activities on wind turbines range from smart flow visualization techniques, custom-made power boost devices helping to raise the power output of wind turbines and the development of smart blades for the wind turbines of the future.

His scientific and technology achievements/contributions comprise of more than 500 Journal and conference publications and over 75 patent publications. A number of best paper recognitions, several research awards, and an ERC Advanced Grant underline his competence in combustion and fluid dynamics.

Indian Expert: Dr Aditya Saurabh

Dr. Aditya Saurabh is a faculty at the Department of Mechanical Engineering, IIT Kanpur since 2019. Before joining IIT Kanpur he worked for eight years at the Chair of Fluid Dynamics, TU Berlin. He has previous research experience on several topics associated with gas turbine combustor technology: dynamic and static stability of combustors, thermoacoustic coupling (flame response and self-excited instability dynamics), active and passive damping of instabilities, diagnostics of reacting flows, and combustion noise. He has contributed to research in these fields through highly cited results in high impact international journals (primarily from experiments) concerning fundamental and applied aspects of thermoacoustic instability and flame response, particularly in reference to state-of-the-art annular gas turbine combustors. At IIT Kanpur he is developing a program focused on fundamental research on combustion, acoustics, and aerodynamics within combustion systems, in particular gas turbine combustors; and novel combustion technologies that would address shortcomings (efficiency, pollutant emission, instabilities) and obstacles in the further development of present-day technology.

For any information regarding eligibility, fee payment, travel information, accommodation, etc., please contact the course coordinator via e-mail or phone.

Course Co-Coordinator

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