

- INTRODUCTION TO MEASUREMENT TECHNIQUES
OCTOBER 8-12, 2012
- INTRODUCTION TO CFD
JANUARY 21-25, 2013
- CUBESAT TECHNOLOGY AND APPLICATIONS
JANUARY 29 - FEBRUARY 1, 2013
- CFD FOR ATMOSPHERIC FLOWS AND WIND
ENGINEERING
MARCH 11-13, 2013
- RADIAL COMPRESSOR DESIGN
MARCH 11-15, 2013
- ACCURATE AND EFFICIENT AEROACOUSTIC
PREDICTION APPROACHES FOR AIRFRAME NOISE
MARCH 25-28, 2013
- AEROENGINE DESIGN: FROM STATE OF THE ART
TURBOFANS TOWARDS INNOVATIVE
ARCHITECTURES
APRIL 9-12, 2013
- FLUID DYNAMICS ASSOCIATED TO LAUNCHER
DEVELOPERS (STO-AVT-VKI-206)
APRIL 15-17, 2013
- RADIATION AND GAS-SURFACE INTERACTION
PHENOMENA IN HIGH SPEED RE-ENTRY
(STO-AVT-VKI-218)
MAY 6-8, 2013
- TURBULENT COMBUSTION
MAY 13-17, 2013
- SOURCE TERM CHARACTERIZATION OF THE
CONSEQUENCES OF STORAGE TANK
AGGRESSIONS (STO-AVT-VKI-219)
JUNE 4-6, 2013
- TRANSITION AND TURBULENCE IN HIGH-SPEED
FLOW
JUNE 10-14, 2013
- FLOW CHARACTERISTICS AND PERFORMANCE OF
SAFETY VALVES
SEPTEMBER 9-11, 2013
- ACCURATE TEMPERATURE MEASUREMENTS
SEPTEMBER 16-20, 2013
- 37TH COMPUTATIONAL FLUID DYNAMICS:
ADJOINT METHODS IN CFD
TO BE DETERMINED

ONLINE REGISTRATION AVAILABLE

<https://www.vki.ac.be/registration>

It is highly recommended that the registration is sent at the latest 15 days before the beginning of the course. A letter of acceptance and additional information will be sent on receipt of the application form.

COURSE FEE

The fee for the lecture series is 1350 euro, applicable to citizens of NATO countries contributing to the financing of the VKI (Belgium, Czech Republic, France, Germany, Hungary, Iceland, Italy, Luxemburg, Norway, Portugal, Spain and Turkey).

For citizens of other NATO countries and of NATO partner countries, the fee is 1760 euro. For non-NATO citizens the fee is 1920 euro. These prices include 21% VAT. The fee includes printed notes, lunches, beverages, and administrative costs.

Lectures will be given in English and printed notes will be distributed during registration.

FELLOWSHIPS

To encourage greater participation in our Lecture Series programme by university members, the Institute has established a limited number of VKI Lecture Series fellowships for citizens of NATO countries contributing to the financing of the VKI, as well as for citizens of other NATO countries and NATO partner countries coming from a university in a VKI financing country.

The recipient of such fellowship is entitled to attend the Lecture Series at a reduced fee, which will be 675 euro (VAT included) for assistants not having a Ph.D. degree and for Ph.D. candidates, and 300 euro (VAT included) for undergraduate students. For non-NATO citizens coming from a university in a VKI financing country, the fee is 960 euro (VAT included) for assistants not having a Ph.D. degree and for Ph.D. candidates, and 400 euro (VAT included) for undergraduate students.

The request to be considered for an award must accompany the application to attend the Lecture Series, and the applicant must provide a recommendation letter from his or her professor; if not done so, the request will not be taken into consideration. All possible alternative sources of funding should be investigated before aid is requested under this scheme, so that those most in need will benefit.

von KARMAN INSTITUTE FOR FLUID DYNAMICS

**Aeroengine Design:
from State of the Art
Turbofans towards
Innovative Architectures**

April 9-12, 2013



INTRODUCTION

The first lectures will focus on the preliminary design of state of the art turbofan engine for the propulsion of civil aircrafts. Issues like thermodynamic cycle, mission analysis, and off design operation (operating line) will be addressed. Practical examples will be presented. Once this important phase is completed, the different design teams have the boundary conditions to start the design of each component.

This starts with the fan that must cope with a number of constraints in terms of mechanical resistance, noise and surge margin. The aerodynamic design involves both subsonic flow at the hub and supersonic flow at the tip.

The design of the booster (low pressure compressor) will then be addressed where the multistage operation and the matching between successive stages are important concerns.

Moving to the high pressure compressor, the lectures will first describe the preliminary design based on throughflow calculations. Then, airfoil design, from 2D sections to stage matching optimisation will be addressed. Current trends for future HPC configurations will be outlined.

The design of the combustion chamber involves a number of disciplines such as aerodynamics, fuel atomisation, chemistry of combustion and combustor cooling as well as environmental regulatory issues for emissions (NO_x, CO, UHC, soot) along with future combustor technologies. Each of these topics will be reviewed while addressing the design of the combustion chamber.

Concerns related to fuel consumption and environmentally friendliness have pushed the engine manufacturer community to look into innovative architectures. An overview of advanced concepts related to fuel burn reduction will be addressed to improve thermal efficiency and propulsive efficiency, among which open rotor engines, boundary layer ingestion configurations, intercooled engines, non-Brayton cycles ...

The high-pressure turbine has the particularity to be submitted to high levels of centrifugal force and exposure to very hot burned gases. The design process, involving successively 1D, 2D and 3D analysis is targeting the highest stage efficiency while accommodating for the cooling of the blades.

Finally, the low-pressure turbine design must satisfy high efficiency together with low weight, cost and noise. This is defined primarily by the load and flow coefficients and the number of airfoils. New lightweight/lowcost configurations tend to reduce the number of blades thanks to high lift designs that take advantage of the positive effects of the unsteady row interaction on the airfoil boundary layer behaviour.

The Lecture Series directors are Dr. R. Dénos, DG Research, 'Aeronautics', European Commission and Prof. G. Paniagua, von Karman Institute for Fluid Dynamics.



VON KARMAN INSTITUTE FOR
FLUID DYNAMICS

PRELIMINARY SCHEDULE

Tuesday 9 April 2013

- 08:45 Registration
- 09:15 Welcome Address
- 09:30 Preliminary Design
J. Kurzke, GasTurb, Germany
- 10:45 Coffee Break
- 11:15 Preliminary Design (Continued)
J. Kurzke
- 12:30 Lunch Break
- 14:00 Fan Design
Nigel Smith, Rolls-Royce Plc, United Kingdom
- 15:15 Coffee Break
- 15:45 Booster Design
Nigel Smith
- 17:00 Reception

Wednesday 10 April 2013

- 09:00 HP Compressor: Preliminary Design
T. Obrecht, Snecma, France
- 10:15 Coffee Break
- 11:00 HP Compressor Aerodynamics
O. Domercq, Snecma, France
- 12:00 Lunch Break
- 14:00 Combustion Chamber
T. Doerr, Rolls-Royce Deutschland, Germany
- 15:15 Coffee Break
- 15:45 Combustion Chamber (Continued)
T. Doerr

Thursday 11 April 2013

- 9:00 Innovative Architecture I
N. Tantot, Snecma, France
- 10:15 Coffee Break
- 10:45 Innovative Architecture II
N. Tantot
- 12:30 Lunch Break
- 14:00 Lab tour

Friday 12 April 2013

- 9:00 HP Turbine
F. Haselbach, Rolls-Royce Plc, United Kingdom
- 10:15 Coffee Break
- 10:45 HP Turbine (Continued)
F. Haselbach
- 12:30 Lunch Break
- 14:00 LP Turbine
R. Vazquez, ITP, Spain
- 15:15 Coffee Break
- 15:45 LP Turbine
R. Vazquez
- 17:00 End of Lecture Series

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