

Lecture Series Secretary
von Karman Institute for Fluid Dynamics
72 Chaussée de Waterloo
B-1640 Rhode-St-Genèse
Belgium

Please correct your address if necessary)



**von KARMAN INSTITUTE
FOR FLUID DYNAMICS**

INTRODUCTION TO MEASUREMENT TECHNIQUES



AITEB-2 Tip Flows
Sixth Framework Programme

October 6 - 10, 2008

von Karman Institute for Fluid Dynamics
72, Chaussée de Waterloo
1640 Rhode-Saint-Genèse, Belgium

Phone: +32(0)2 359 96 04 - Fax: +32(0)2 359 96 00
E-mail: secretariat@vki.ac.be, TVA BE 0407 185 709
Website: <http://www.vki.ac.be>

INTRODUCTION

The objective of this course is to provide young engineers with a broad overview of traditional and advanced measurement techniques applicable to fluid dynamics.

Each measurement technique and its field of application will be described. Limitations and advantages will be discussed and special attention will be given to the subject of error estimation.

A choice of relevant techniques will be demonstrated to groups of five people maximum during lab sessions on Thursday afternoon and Friday in the VKI facilities. This will provide an opportunity to manipulate the available hardware and will allow for discussion of individual problems.

This course, prepared and presented by the VKI teaching staff, is based on a long experience with the different techniques for research applications.

TIMETABLE

The course starts on Monday 6 October 2008 at 09h00 and ends on the following Friday at 15h00.

Lunch will be taken from 12h05 to 13h45. Coffee breaks are scheduled each morning and afternoon.

GENERAL OUTLINE OF THE COURSE

1. Components of a measurement chain

2. Measurement uncertainties and errors

3. Transducers

- active and passive transducers
- transducers for different applications
- amplifiers (types and matching)
- frequency response

4. Pressure measurements

- static pressure (description and errors)
- total pressure (probes and errors)
- flow direction measurements (2 & 3 dimensional)
- unsteady pressure measurements (frequency response & calibration)

5. Temperature measurements

- thermocouples, cold wires
- surface measurement devices (thin films – liquid crystals)
- infrared thermography (principles – spatial resolution – quality factor)

6. Hot wire anemometry

- probe construction and calibration
- control circuits & linearisation
- angular response
- turbulence measurements

7. Optical measurement techniques

- laser doppler velocimetry (LDV)
- particle image velocimetry (PIV)
- optical density & spectroscopic measurements

8. Flow visualisation

- air and water flows
- streamlines and skin friction lines

9. Force measurements

10. Signal displays, recording & processing

- display, recording
- analog to digital conversion
- Fourier analysis
- numerical systems and their application for data processing

The following demonstrations are scheduled on Thursday afternoon and Friday :

- LDV, PIV & holographic interferometry
- hot wires
- infrared thermography
- thin films, liquid crystals, thermocouples, and cold wires
- steady and unsteady pressure measurements
- flow visualisation (watertunnel, schlieren, shadowgraph, oil flow, etc.)

Lectures are given by Professors J. Anthoine, T. Arts, J.-F. Brouckaert, J.-M. Buchlin, M. Carbonaro, O. Chazot, M. Riethmuller, R.A. Van den Braembussche and Dr. M. Playez of the von Karman Institute. The Director of this course is Professor R.A. Van den Braembussche of the von Karman Institute.

Please pass this announcement to someone who may be interested if you are unable to attend the Lecture Series yourself

APPLICATION FOR ADMISSION TO VKI LECTURE SERIES

Lecture Series Title:

☐ Mr ☐ Mrs

Family name: Firstname: Nationality:

Name & full address of organisation, institution or university:

Phone nr: Fax nr:

Position or title: E-mail:

☐ Asking a reduced fee and joining a recommendation letter as: ☐ undergraduate student ☐ Ph.D. candidate or University assistant

Company / University VAT number:
VAT of the von Karman Institute: BE 0407 185 709

HOTEL RESERVATION (if applicable)

I require accommodation at Hotel for person(s)

Single: Double: Date of arrival:

I shall require transport to and from the Institute ☐ Date of departure:

I do not require transport to and from the Institute ☐

Please indicate any special needs (e.g. vegetarian, ...):

Date: Signature:

ACCOMMODATION & TRANSPORT

Participants are advised to make their reservations as early as possible. VKI secretariat (secretariat@vki.ac.be) can book rooms upon request in the recommended hotels listed below. Daily rates include all charges and continental breakfast. These prices could be subject to changes. However, participants could occasionally find special offers on hotel websites.

Hôtel des Colonies
http://www.hotel-des-colonies.com Single: 120 € / Double: 140 €

Hôtel Vendôme
http://www.hotel-vendome.be Single: 105€ / Double: 130 €

Hôtel Marivaux
http://www.marivaux.be Single: 140 € / Double: 165 €

Thon Hotel Brussels City Centre
http://www.thonhotels.be/ Single: 142 € / Double: 174 €

Hôtel Le Dôme
http://www.hotel-le-dome.be Single: 125 € / Double: 145 €

Hôtel Orts
http://www.hotelorts.com Single: 200 € / Double: 250 €

Progress Hôtel
http://www.progresshotel.be Single: 200 € / Double: 220 €

At youth hostel, the Sleepwell, is within walking distance of the recommended hotels. We invite you to make your own reservation through their website: <http://www.sleepwell.be>.

The hotels situated in Brussels are all within walking distance from the Gare du Nord and the Place Rogier. A train service links the airport with the Gare du Nord (15' journey). Complete your journey to the hotel/youth hostel on foot or by taxi. Each morning and evening, bus transport will be provided between the Place Rogier and the von Karman Institute, located in Rhode-Saint-Genèse, a suburb south of Brussels.

The following hotels are also recommended, particularly for those who travel by private car.

Auberge de Waterloo****
Chaussée de Waterloo 212 - 1640 Rhode-Saint-Genèse
Tel: +32 (0)2 358 35 80 - Fax : +32 (0)2 358 38 06
<http://www.aubergedewaterloo.be> (1 single room: +/- 106€)

Gravenhof Hotel
Alsebergsesteenweg 616 - B-1653 Dworp
Tel: +32 2 380 44 99 - Fax: +32 2 380 40 60
<http://www.gravenhof.be> (1 single room: +/- 105 €, breakfast not included)

For more information about the location of the Institute and the hotels, please visit our website on <http://www.vki.ac.be>.



Please mail under -cover to VKI

Programme

LECTURE SERIES
2008-2009



- ☒ INTRODUCTION TO MEASUREMENT TECHNIQUES
(6-10 OCTOBER 2008)
- ☐ 35TH CFD / ADIGMA COURSE ON VERY HIGH ORDER DISCRETIZATION METHODS
(13-17 OCTOBER 2008)
- ☐ INTRODUCTION TO CFD
(12-16 JANUARY 2009)
- ☐ RECENT ADVANCES IN PARTICLE IMAGE VELOCIMETRY
(26-30 JANUARY 2009)
- ☐ MODELING AND COMPUTATION OF NANOPARTICLES IN FLUID FLOWS (RTO-AVT-VKI)
(9-12 FEBRUARY 2009)
- ☐ FLOW CONTROL: FUNDAMENTALS, ADVANCES AND APPLICATIONS
(2-6 MARCH 2009)
- ☐ AERODYNAMIC NOISE FROM WALL-BOUNDED FLOWS
(9-13 MARCH 2009)
- ☐ LIQUID INJECTION/FRAGMENTATION IN HIGH-SPEED CROSSFLOW
(16-18 MARCH 2009)
- ☐ NUMERICAL INVESTIGATIONS IN TURBOMACHINERY: THE STATE OF THE ART
(20-24 APRIL 2009)
- ☐ HIGH PERFORMANCE COMPUTING OF INDUSTRIAL FLOWS
(4-8 MAY 2009)
- ☐ TURBULENT COMBUSTION
(25-29 MAY 2009)
- ☐ ADVANCED HIGH TEMPERATURE INSTRUMENTATION FOR GAS TURBINE APPLICATIONS
(8-12 JUNE 2009)
- ☐ COMPUTATIONAL AEROELASTICITY AND FLUID-STRUCTURE INTERACTION
(NOT YET DEFINED)

OTHER CONFERENCES:

- ☐ PHYSMOD 2009: INTERNATIONAL WORKSHOP ON PHYSICAL MODELLING OF FLOW AND DISPERSION PHENOMENA
(24-26 AOÛT 2009 - could be subject to change)
- ☐ 4TH SYMPOSIUM ON INTEGRATION CFD AND EXPERIMENTS IN AERODYNAMICS
(14-16 SEPTEMBER 2009)

COURSE FEE

The fee for the lecture series is 1.300 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 1.700 euro. For non-NATO citizens the fee is of 1.850 euro. These prices include 21% VAT.

The fee includes printed notes, transport between VKI from and to the recommended hotels, lunches, beverages, and administrative costs.

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 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 of 650 euro (VAT included) for assistants not having a Ph.D. degree and for Ph.D. candidates, or 300 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.

METHODS OF PAYMENT

Payment 2 weeks prior to the beginning of the course (name and course title clearly indicated) by bank transfer to our account Nr 210-0315330-35 at Fortis Bank, avenue de la Forêt de Soignes 322, 1640 Rhode-Saint-Genèse, Belgium, IBAN BE57 2100 3153 3035 (strongly recommended). SWIFT BIC GEBABEBB.

Late registration can be paid in cash (EURO), or by VISA or Eurocard at the beginning of the course.

PROCEEDINGS

Lectures will be given in English and printed notes will be distributed during registration. Proceedings of other non-RTO lecture series may be purchased at VKI (by e-mail: vanhaelen@vki.ac.be or by fax : 32 2 359 96 00). Information can be found on <http://www.vki.ac.be>.

HOW TO REGISTER

It is highly recommended that the registration/hotel reservation form be 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.