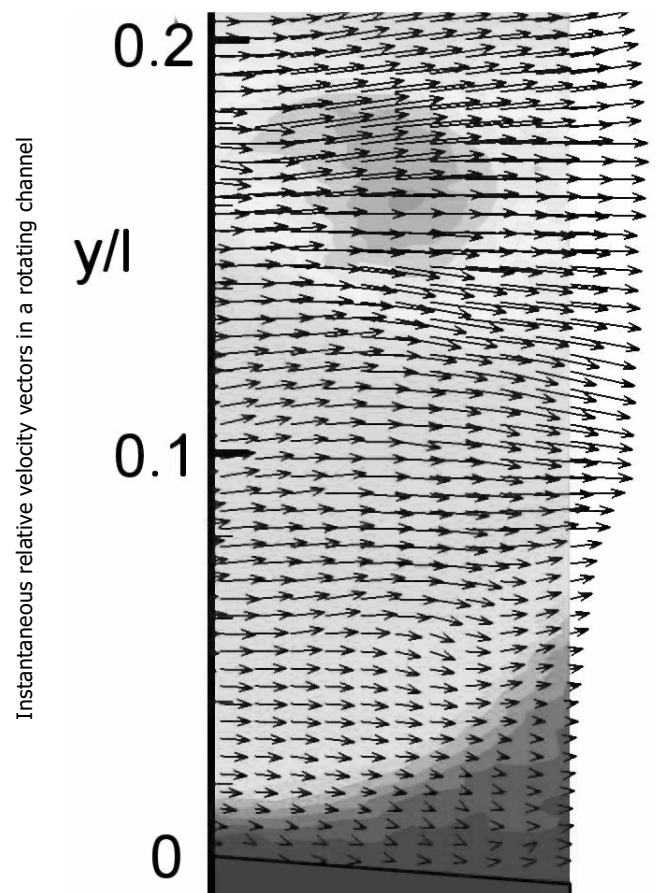




**von KARMAN INSTITUTE
FOR FLUID DYNAMICS**

INTRODUCTION TO MEASUREMENT TECHNIQUES



October 8 - 12, 2007

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

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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.

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

TIMETABLE

The course starts on Monday 8 October 2007 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.

8 Flow visualisation

- air and water flows
- streamlines and skin friction lines

9 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.L. 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:

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

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:

HOW TO REGISTER

It is highly recommended to send the registration/hotel reservation form 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.

ACCOMMODATION & TRANSPORT

Participants are advised to make their reservations as early as possible through VKI (secretariat@vki.ac.be) in order to benefit from special rates offered by the recommended hotels listed below. Daily rates include all charges and continental breakfast. The price are available until September 2007. After this date, prices are subject to change.

Hôtel des Colonies***
http://www.hotel-des-colonies.com Single: 95 € / Double: 105 €

Hôtel Vendôme***L
http://www.hotel-vendome.be Single: 98 € / Double: 118 €

Thon Hotel Brussels City Centre****
http://www.thonhotels.be/ Single: 105 € / Double: 115 €

Hilton Brussels City****
http://www.hilton.com Single: 130 € / Double: 180 €

A 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 hotel, which is about 1.5 km from the Institute, is also recommended, particularly for those who travel by private car. The hotel is about 12km from the center of Brussels and a high standard of comfort is assured.

Auberge de Waterloo****
e-mail: aubergedewaterloo@skynet.be
Single: 106 € / Double: 123 €
Fax : +32 (0)2 358 38 06
Tel: +32 (0)2 358 35 80
Chaussée de Waterloo 212 - 1640 Rhode-Saint-Genèse

For more information about the localization 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
2007-2008



- ☒ INTRODUCTION TO MEASUREMENT TECHNIQUES
(8-12 OCTOBER 2007)
- ☐ BASICS OF AEROACOUSTICS AND THERMOACOUSTICS
(3-7 DECEMBER 2007)
- ☐ 35TH CFD / ADIGMA COURSE ON VERY HIGH ORDER DISCRETIZATION METHODS.
(21-25 JANUARY, 2008)
- ☐ INTRODUCTION TO CFD
(28 JANUARY-1 FEBRUARY 2008)
- ☐ POST-PROCESSING OF NUMERICAL & EXPERIMENTAL DATA
(11-15 FEBRUARY 2008)
- ☐ EXPERIMENTAL DETERMINATION OF DYNAMIC STABILITY PARAMETERS
(18-22 FEBRUARY 2008)
- ☐ AEROENGINE DESIGN
(3-7 MARCH 2008)
- ☐ LARGE EDDY SIMULATION AND RELATED TECHNIQUES. THEORY AND APPLICATIONS
(10-14 MARCH 2008)
- ☐ STRUCTURAL DESIGN OF AIRCRAFT ENGINES - KEY OBJECTIVES AND TECHNIQUES
(12-16 MAY 2008)
- ☐ ATMOSPHERIC BOUNDARY LAYER FLOWS IN AIR POLLUTION MODELLING
(19-23 MAY 2008)
- ☐ OPTIMIZATION AND MULTI-DISCIPLINARY DESIGN
(2-6 JUNE 2008)
- ☐ NON-EQUILIBRIUM GAS DYNAMICS, FROM PHYSICAL MODELS TO HYPERSONIC FLIGHTS (RTO-AVT-VKI)
(8-12 SEPTEMBER 2008)
- ☐ ADVANCES IN LAMINAR-TURBULENT TRANSITION MODELLING (RTO-AVT-VKI)
(NOT YET DEFINED)

COURSE FEE

The fee for the lecture series is 980 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 of 1275 euro. For non-NATO citizens, the fee is of 1375 euro.

The fee includes printed notes, transport between VKI 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. The recipient of a fellowship is entitled to attend the VKI Lecture Series at a reduced fee, which will be of 490 euro for assistants not having a Ph.D. degree and for Ph.D. candidates, or 245 euro for undergraduate students. These reduced fees are also available for all NATO citizens coming from a university in a VKI financing country.

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).

Late registration can be paid cash in EURO, or by VISA or Eurocard at the beginning of the course. Payment must be the equivalent of the fee at the prevailing rate of exchange.

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 (e-mail : vanhaelen@vki.ac.be or fax : 32 2 359 96 00). Information can be found on <http://www.vki.ac.be>.