

- ☐ INTRODUCTION TO MEASUREMENT TECHNIQUES
OCTOBER 7-11, 2013
- ☒ ADVANCED POST-PROCESSING OF EXPERIMENTAL AND NUMERICAL DATA
NOVEMBER 4-7, 2013
- ☐ FLUID MECHANICS AND CHEMISTRY FOR SAFETY ISSUES IN HLM NUCLEAR REACTORS
NOVEMBER 25-27, 2013
- ☐ 37TH ADVANCED VKI CFD LECTURE SERIES: RECENT DEVELOPMENTS IN HIGHER ORDER METHODS AND INDUSTRIAL APPLICATION IN AERONAUTICS
DECEMBER 9-12, 2013
- ☐ INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS
JANUARY 20-24, 2014
- ☐ HYPersonic FLIGHT TESTING (VKI-STO-AVT-234)
MARCH 24-28, 2014
- ☐ INTRODUCTION TO OPTIMIZATION AND MULTIDISCIPLINARY DESIGN IN AERONAUTICS AND TURBOMACHINERY
APRIL 7-11, 2014
- ☐ LARGE EDDY SIMULATION
MAY 5-9, 2014
- ☐ SPECTROSCOPY AND SPECTROSCOPIC MEASUREMENT TECHNIQUES FOR AEROSPACE FLOWS
MAY 13-16, 2014
- ☐ UAV & SMALL AIRCRAFT DESIGN
MAY 20-22, 2014
- ☐ UNCERTAINTY QUANTIFICATION IN COMPUTATIONAL FLUID DYNAMICS (VKI-STO-AVT-235) AT STANFORD, CALIFORNIA
MAY 26-27, 2014
- ☐ PROGRESS IN FLOW INSTABILITY ANALYSIS AND LAMINAR-TURBULENT TRANSITION MODELING
JUNE 2-6, 2014
- ☐ PHYSICS OF SLOSHING LIQUIDS: EXPERIMENTS AND MODELING
SEPTEMBER 1-5, 2014
- ☐ UNCERTAINTY QUANTIFICATION IN COMPUTATIONAL FLUID DYNAMICS (VKI-STO-AVT-235)
SEPTEMBER 22-26, 2014

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 (4 days)

VAT included	Type 1 (€)	Type 2 (€)	Type 3 (€)
Normal Fee	1350	1760	1920
PhD Candidate Fee	675	675	960
Undergraduate Student Fee	300	300	400

Type 1: Permanent residents of NATO countries funding VKI: Belgium, Czech Rep., France, Germany, Hungary, Iceland, Italy, Luxembourg, Norway, Portugal, Spain and Turkey

Type 2: Permanent residents of NATO countries not funding VKI or NATO partners countries

Type 3: Permanent residents of non -NATO countries

REDUCTION

-50% for the 3rd & 4th, ... participant in the same company.

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.

The fee includes printed notes, lunches, beverages, and administrative costs.

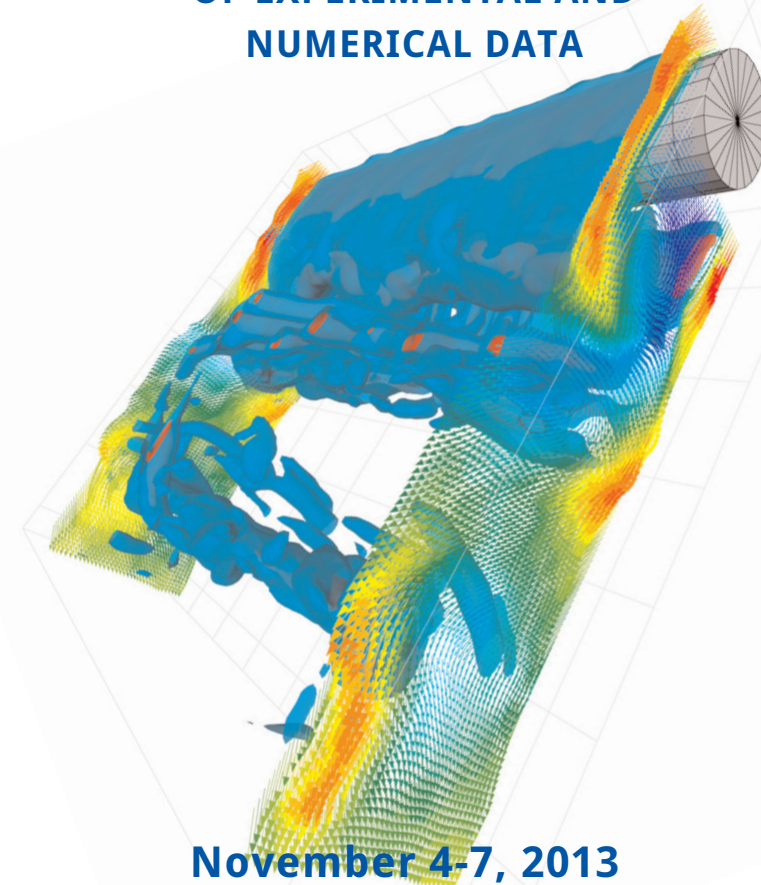
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von KARMAN INSTITUTE
FOR FLUID DYNAMICS

ADVANCED POST-PROCESSING OF EXPERIMENTAL AND NUMERICAL DATA



November 4-7, 2013



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This course was organized successively in 2002, 2003 and 2008 and always proved to be very successful. Since the last edition of this Lecture Series, major scientific and technological achievements have made their way in the experimental and numerical fields. It is therefore quite opportune to update and repeat this course according to these evolutions.

Recent advances in numerical simulation capabilities as well as in measurement techniques have enabled the generation of very large amounts of data in the field of fluid mechanics. It has therefore become difficult to extract synthetic or phenomenological information from these large quantities of detailed flow data and specific post-processing techniques must be applied to obtain the benefits of these superior tools. It is the objective of this Lecture Series to present and discuss advanced processing methods and techniques that allow extracting physical characteristics of flows from sets of data that represent spatial and temporal distributions containing occasionally random aspects.

The Lecture Series is organized in four days, and will cover fundamental aspects of turbulence analysis including sampling aspects, spectral analysis, the processing of correlated datasets and the extraction of coherent structures, with a specific emphasis on the analysis of massive datasets such as generated by time-resolved LES- or DNS-like simulations and advanced volume experimental techniques, e.g. tomographic PIV. The course will also depict the most modern implementations of techniques having already proved their usefulness and efficiency, such as Proper Orthogonal Decomposition, wavelet analysis, Linear Stochastic Estimation, and Dynamic Mode Decomposition. As a contribution from the European project AFDAR dedicated to advanced PIV developments and analysis, lectures will be specifically dedicated to the post-processing of time-resolved tomographic PIV and to the reconstruction of pressure fields from PIV datasets, opening new perspectives in fields such as aeroacoustics. In the same field, the mechanisms associating coherent structure dynamics with noise production will be explored by means of dedicated developments of the Proper Orthogonal Decomposition technique. In the important field of turbomachinery (and generally for applications showing some degree of periodicity), a lecture will be dedicated to the detailed analysis of uncertainties associated with phase-locked averaging, with the aim of permitting quantitative cross-validation of experimental and numerical data. A lecture will be dedicated to practical issues that arise when dealing with very large simulations (with mesh sizes reaching 1 billion of dofs). Finally, recent algorithmic and technological developments permitting to visualize large 3D datasets will be presented as well.

Some developments and results presented in this Lecture Series have been obtained within the framework of the EC-funded FP7 project AFDAR (Grant Agreement no 265695), which support is hereby gratefully acknowledged

The Directors of this lecture series are Prof. L. David, Institut P', CNRS - Université de Poitiers, and Prof. C. Schram, von Karman Institute.



VON KARMAN INSTITUTE
FOR FLUID DYNAMICS

PROGRAM SCHEDULE

MONDAY 4 November 2013

- 9:00 Welcome
- 9:45 Fundamentals in turbulence, basic tools and basics of sampling
C. Kaehler, U. der Bundeswehr München, Germany
- 10:15 Coffee break
- 10:45 POD and ROM (variational approach)
L. Cordier, CNRS, Institut PPRIME, France
- 12:00 Lunch
- 14:00 Uncertainty and spectral data analysis of turbulence
J. M Foucaut, Ecole Centrale de Lille, France
- 15:15 Coffee break
- 15:45 Extraction of coherent structures
L. Pastur, LIMSI, Université Paris Sud, France
- 17:00 Reception

TUESDAY 5 November 2013

- 9:00 Reconstruction of pressure from PIV data
B. Van Oudheusden, TUDelft, The Netherlands
- 10:15 Coffee break

- 10:45 Dynamic Mode Decomposition
P. Schmid, E Imperial College London, United Kingdom
- 12:00 Lunch
- 14:00 Measurement of wall-pressure fluctuations and statistics
R. Camussi, Universita Roma 3, Italy
- 15:15 Coffee break
- 15:45 Wavelet analysis and Linear Stochastic Estimation
R. Camussi

WEDNESDAY 6 NOVEMBER 2013

- 9:00 Application of POD to coherent structure eduction and aeroacoustics
P. Jordan, CNRS, Institut Pprime, France
- 10:15 Coffee break
- 10:45 Post-processing of time-resolved, tomographic PIV
F. Scarano, TU Delft, The Netherlands
- 12:00 Lunch
- 14:00 Visit of the VKI laboratories
- 15:15 Coffee break

- 15:45 Advanced 3D Flow Visualization
H.C. Hege, TU Berlin, Germany

THURSDAY 7 NOVEMBER 2013

- 9:00 Phase-locked averaging for turbomachinery applications
J-F. Brouckaert, von Karman Institute for Fluid Dynamics, Belgium
- 10:15 Coffee break
- 10:45 Processing correlated datasets
L. Chatellier, Institut Pprime, Université de Poitiers, France
- 12:00 Lunch
- 14:00 Load evaluation from optical measurements
L. David, Institut Pprime, Université de Poitiers, France
- 15:15 Coffee break
- 15:45 Analysis of large amount of numerical data
V. Moureau, CORIA, CNRS, France
- 17:00 End of Lecture Series