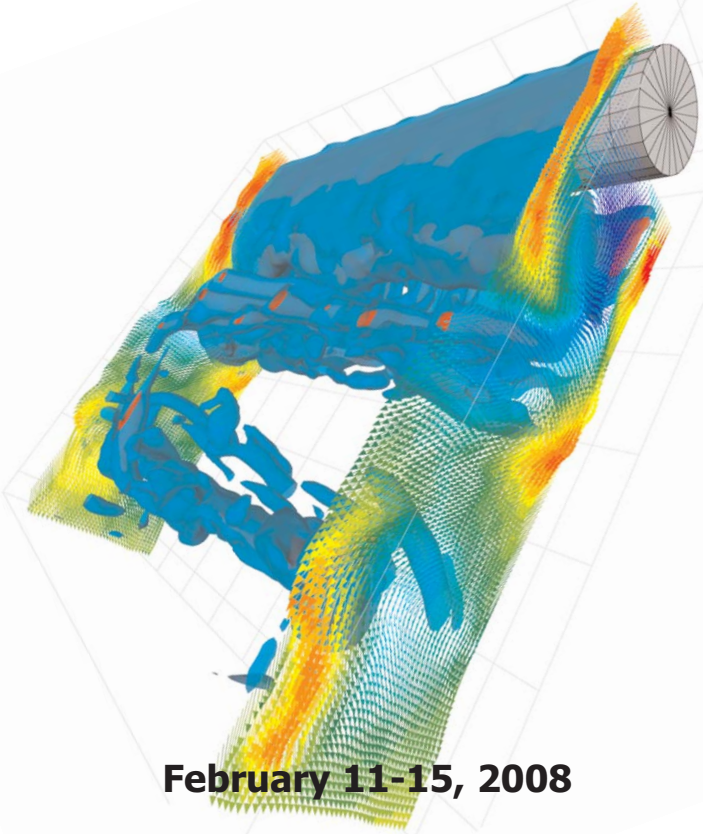
Please correct your address if necessary)

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

von KARMAN INSTITUTE
FOR FLUID DYNAMICS

POST-PROCESSING OF NUMERICAL & EXPERIMENTAL DATA



February 11-15, 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

This course was first organized successively in 2002 and 2003 and proved to be very successful. Since that time, many things have evolved in the experimental and numerical world. It is therefore the right moment to repeat this Lecture Series that is updated to adapt to the recent evolutions.

Recent advances in numerical simulation capability 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 a survey of 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 into four sections.The first one will be an introductory course that will present, as a reminder, the different classes of problems encountered in fluid dynamics and will put in evidence the needs of experimental and numerical approaches. In the second section, the nature of the data yield by numerical and experimental techniques will be analyzed in view of the intricacy of extracting the information required for the modeling of fluid dynamics problems. Some emphasis will be given to the very recent progress made in 3D, time dependent PIV techniques and to the processing of the data yielded by this new advanced measurement technique. The different data processing techniques such as spectral analysis, pattern recognition, Proper Orthogonal Decomposition (POD) and wavelet analysis will be discussed in the third section. Finally the last section will be devoted to the presentation of examples of application of the various post-processing techniques in different domains of fluid dynamics with an emphasis on the analysis of turbulent flow fields. The Lecture Series should prove fruitful to both newcomers to post-processing and experienced researchers who will find here a useful update.

The Directors of this Lecture Series are Dr. Pierre Millan, ONERA Toulouse, and Prof. Michel Riethmuller, von Karman Institute

TIMETABLE

MONDAY FEBRUARY 11, 2008

08:45 **Welcome address**

09:30 **Structure and objectives of the lecture series**
P. Millan, ONERA, France

09:55 **Introduction to the measurement of turbulence in fluid dynamics**
C.Tropea, Technische Universität Darmstadt, Germany

11:15 **Survey of signal processing techniques**
D. Veynante, Ecole Centrale de Paris, France

14:00 **Data processing by wavelet transforms**
D. Veynante

15:45 **Optical techniques for velocity measurements and nature of data produced**
A. Boutier, ONERA, France

17:00 **Reception**

TUESDAY FEBRUARY 12, 2008

09:00 **Optical techniques for velocity measurements and nature of data produced (continued)**
A. Boutier

10:45 **Introduction to proper orthogonal decomposition**
L. Cordier, LEA, France

14:00 **Requirements of the processing of data of random nature in fluid dynamics**
C.Tropea

15:45 **Processing of time dependent data**
C.Tropea

WEDNESDAY FEBRUARY 13, 2008

09:00 **Application of proper orthogonal decomposition**
L. Cordier

10:45 **Numerical data post-processing (DNS, LES, DES, ...): from validation to physical understanding**
P. Sagaut, Université Pierre et Marie Curie, France

14:00 **Numerical data post-processing (DNS, LES, DES, ...): from validation to physical understanding (Continued)**
P. Sagaut

THURSDAY FEBRUARY 14, 2008

09:00 **Coherent structures in turbulent flows and their possible impacts on numerical simulations**
J. Delville, LEA, France

10:45 **Coherent structures in turbulent flows and their possible impacts on numerical simulations (Continued)**
J. Delville

14:00 **3D velocity measurements by tomographic particle image velocimetry**
F. Scarano, Delft University of Technology, The Netherlands

15:45 **3D velocity measurements by tomographic particle image velocimetry (Continued)**
F. Scarano

FRIDAY FEBRUARY 15, 2008

09:00 **Post-processing of 3C,3D,T measurements**
F. Scarano

10:45 **Application and limitations of wavelet transform and POD to vortical flows**
M. Bilka, von Karman Institute for Fluid Dynamics, Belgium

14:00 **VKI bus departure**

PRACTICAL INFORMATION

Lunch will be taken from 12h30 to 14h00. Coffee breaks are scheduled each morning and afternoon.

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