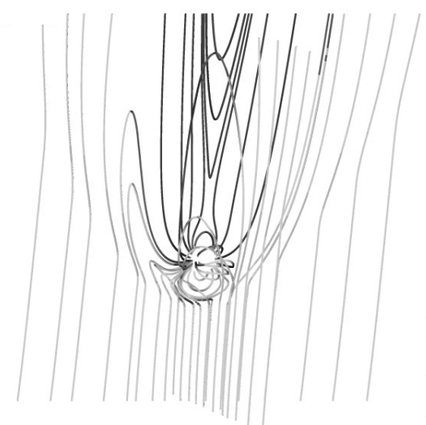
(Please correct your address if necessary)

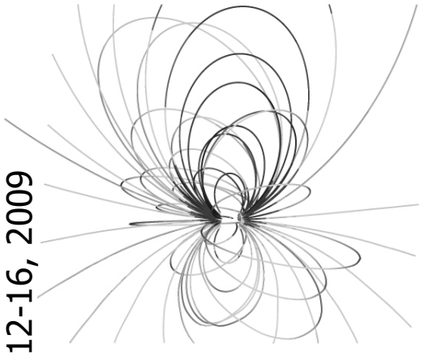
Lecture Series Secretary
von Karman Institute for Fluid Dynamics
72 Chaussée de Waterloo
B-1640 Rhode-St-Genèse
Belgium

INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

January 12-16, 2009

VON KARMAN INSTITUTE





In the figures, you see the Earth's dipole magnetic field and its interaction with the solar wind. Pictures from the M. Yalim's thesis.

INTRODUCTION

The objective of this course is to provide an elementary tutorial presentation on computational fluid dynamics (CFD), emphasising the fundamentals and surveying a variety of solution techniques whose applications range from low speed incompressible flow to hypersonic flow. The course is aimed at persons who have had little or no experience in this field, both recent graduates as well as professional engineers, and will provide

- an insight into the philosophy and power of CFD
- an understanding of the mathematical nature of the fluid dynamics equations
- a familiarity with various solution techniques

At the conclusion of the course, an attendee will be well prepared to understand the literature in this field, to follow more sophisticated state-of-the-art lecture series, and to begin the application of CFD to his or her special areas of concern. While the techniques to be discussed will be applicable to all fields of fluid dynamics, the lecturers and the majority of examples presented will carry a strong flavor of aeronautics.

The Director of this Lecture Series is Professor G. Degrez 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

TIMETABLE

MONDAY JANUARY 12, 2009

08:45 **Registration**
09:15 **Welcome Address**
09:45 **Basic philosophy of CFD**
Prof. J.D. Anderson, Jr., University of Maryland, USA

11:15 **Forms of the governing equations particularly suited for CFD : non-conservative, conservative, flux vectors**
Prof. J.D. Anderson, Jr.

14:00 **Mathematical properties of the fluid dynamic equations : influence on appropriate numerical techniques; stability considerations**
Prof. J.D. Anderson, Jr.

15:45 **Mathematical properties of the fluid dynamic equations (continued)**
Prof. J.D. Anderson, Jr.

17:00 **Reception**

TUESDAY JANUARY 13, 2009

09:00 **Discretisation of partial differential equations : finite differences**
Prof. J.D. Anderson, Jr.

11:00 **Discretisation of partial differential equations (continued)**
Prof. J.D. Anderson, Jr.

14:00 **Transformation and grids**
Prof. J.D. Anderson, Jr.

15:45 **Explicit methods for inviscid and viscous compressible flows**
Prof. J.D. Anderson, Jr.

WEDNESDAY JANUARY 14, 2009

09:00 **Explicit methods (continued)**
Prof. J.D. Anderson, Jr.

11:00 **Implicit time dependent methods for inviscid and viscous compressible flows**
Prof. G. Degrez, von Karman Institute for Fluid Dynamics, Belgium

14:00 **Implicit methods (continued)**
Prof. G. Degrez

15:45 **Implicit methods (continued)**
Prof. G. Degrez

THURSDAY JANUARY 15, 2009

09:00 **Implicit methods (continued)**
Prof. G. Degrez

11:00 **Finite volume methods**
Prof. E. Dick, University of Gent, Belgium

14:00 **Finite element methods**
Prof. E. Dick

15:45 **Finite element methods (continued)**
Prof. E. Dick

FRIDAY JANUARY 16, 2009

09:00 **Aspects of CFD computations with commercial packages**
Prof. J. Vierendeels, University of Gent, Belgium

11:00 **Boundary layer equations and methods of solution**
Prof. R. Grundmann, TU Dresden, Germany

13:45 **Boundary layer equations (continued)**
Prof. R. Grundmann

15:00 **VKI Bus departure**

PRACTICAL INFORMATION

Lunch will be taken from 12h30 to 13h45, Friday included.
Coffee breaks are scheduled each morning and afternoon.
The afternoon sessions will finish around 17h00.

Von Karman Institute for Fluid Dynamics
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E-mail: secretariat@vki.ac.be, TVA BE 0407185709
Website: http://www.vki.ac.be

Programme

LECTURE SERIES
2008-2009

VKI LS

- [x] INTRODUCTION TO CFD
  (12-16 January 2009)
- [ ] ADVANCES IN LAMINAR-TURBULENT TRANSITION MODELING
  (12-15 January 2009 - at the Wright State University, Ohio, USA)
- [ ] 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 FRAGMENTATION IN HIGH-SPEED FLOW
  (16-18 March 2009)
- [ ] NUMERICAL INVESTIGATIONS IN TURBOMACHINERY: THE STATE OF THE ART
  (20-24 april 2009)
- [ ] HIGH PERFORMANCE COMPUTING OF INDUSTRIAL FLOWS
  (5-7 May 2009)
- [ ] ADVANCED HIGH TEMPERATURE INSTRUMENTATION FOR GAS TURBINE APPLICATIONS
  (11-14 May 2009)
- [ ] TURBULENT COMBUSTION
  (25-29 May 2009)
- [ ] 36TH CFD.ADIGMA COURSE ON VERY HIGH ORDER DISCRETIZATION METHODS
  (June 8-12, 2009)

OTHER CONFERENCES:

- [ ] PHYSMOD 2009: INTERNATIONAL WORKSHOP ON PHYSICAL MODELLING OF FLOW AND DISPERSION PHENOMENA
  (24-26 August 2009)
- [ ] 4TH SYMPOSIUM ON INTEGRATION CFD AND EXPERIMENTS IN AERODYNAMICS
  (14-16 September 2009)

COURSE FEE

The fee for the lecture series is 1300 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 1700 euro. For non-NATO citizens the fee is of 1850 euro. These prices include 21% VAT.

The fee includes printed notes, transport between VKI from and to the recommended hotels in the center of Brussels, 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 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.

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	see the website
Hôtel Marivaux http://www.marivaux.be	see the website
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 €
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 Place Rogier. A train service links the airport with the Gare du Midi. Complete your journey to the hotel/youth hostel 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
(*1single room: +/- 106€*)

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

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

APPLICATION FOR ADMISSION TO VKI LECTURE SERIES

Lecture Series Title:.....

☐ Mr ☐ Mrs
Family name: . . . . . Firstname: . . . . .
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, ...): . . . . . Nationality: . . . . .
. . . . . .
. . . . . .
Date: . . . . . Signature: . . . . .

Please mail under-cover to VKI