

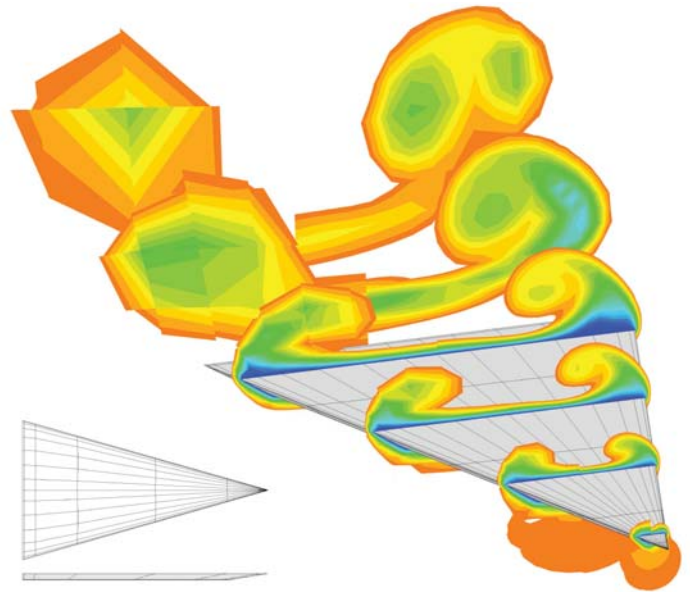
Lecture Series Secretary  
von Karman Institute for Fluid Dynamics  
72 Chaussée de Waterloo  
B-1640 Rhode-St-Genèse  
Belgium

Please correct your address if necessary)



**von KARMAN INSTITUTE  
FOR FLUID DYNAMICS**

# **35<sup>TH</sup> CFD VKI/ADIGMA COURSE ON HIGH ORDER DISCRETIZATION METHODS**



**October 13 - 17, 2008**

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

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## INTRODUCTION

Schemes with order of accuracy higher than two have become an important subject of research in CFD, and the perspective of applying them in industrial aeronautical context is realistic within the next decade. In this course the basics and state of the art of the following methods will be discussed in detail: Discontinuous Galerkin Finite Element methods, Spectral Difference Methods, Spectral Finite Volume methods and finally Residual Distribution schemes, all operating on unstructured grids.

Applications are foreseen in the area of compressible aerodynamics. The course is organized in collaboration with the European Union targeted research project ADIGMA and is oriented towards both junior and experienced engineers and researchers.

The Lecture Series director is Prof. H. Deconinck of the von Karman Institute.

## TIMETABLE

### MONDAY OCTOBER 13

- 09:15 Welcome address, M. Carbonaro, VKI  
09:30 Introduction to Discontinuous Galerkin methods: The basis and model problems  
*F. Bassi, University of Bergamo, Italy & S. Rebay, University of Brescia, Italy*
- 11:15 Introduction to Residual Distribution methods, status and overview  
*H. Deconinck, von Karman Institute, Belgium*
- 14:00 Discontinuous Galerkin methods: A priori error estimates for higher order continuous and discontinuous Galerkin discretizations of model equations  
*R. Hartmann, German Aerospace Center (DLR), Germany*
- 15:45 High-order accurate Discontinuous Galerkin methods: Space discretization for compressible and incompressible flows  
*F. Bassi & S. Rebay*

### TUESDAY OCTOBER 14

- 09:00 Residual Distribution methods for steady Euler equations: Upwind, non upwind schemes, very high order schemes for scalar problems, extension of LP concept, continuous and discontinuous schemes, issue of iterative convergence  
*R. Abgrall, University of Bordeaux, France*
- 10:45 Discontinuous Galerkin methods: Duality-based error estimation for DG methods  
*R. Hartmann*

- 14:00 Spectral Finite Volume and Spectral Difference methods for the Navier-Stokes equations  
*Z.J. Wang, Iowa State University, USA*
- 15:45 High order accurate Discontinuous Galerkin methods: computation of transonic and turbulent complex flows.  
*F. Bassi & S. Rebay*

### WEDNESDAY OCTOBER 15

- 09:00 Residual Distribution methods: Unsteady and Viscous flows. Space-time and decoupled schemes, scalar and system case.  
*R. Abgrall & M. Ricchiuto, INRIA, France*
- 10:45 Discontinuous Galerkin methods: Adjoint consistency analysis for DG discretizations of compressible flows  
*R. Hartmann*
- 14:00 Spectral Finite Volume and Spectral Difference methods for the Navier-Stokes equations  
*Z.J. Wang, Iowa State University, USA*
- 15:45 Discontinuous Galerkin methods. Implementation issues  
*K. Hillewaert, CENAERO, Belgium*

### THURSDAY OCTOBER 16

- 09:00 An explicit space-time Discontinuous Galerkin method: I. Basic building blocks  
*C.-D. Munz, University of Stuttgart, Germany*
- 10:45 Analysis of Discontinuous Galerkin methods  
*V. Dolejsi, Charles University Prague, Czech Republic*
- 14:00 Spectral Finite Volume and Finite Difference methods  
*K. van den Abeele, Vrije Universiteit Brussel, Belgium*
- 15:45 Residual Distribution methods: Unsteady and Viscous flows  
*T. Quintino, von Karman Institute, Belgium*

### FRIDAY OCTOBER 17

- 9:00 Analysis of Discontinuous Galerkin methods  
*V. Dolejsi*
- 10:45 Discontinuous Galerkin methods: II. Diffusion fluxes, polymorphic elements and applications  
*C.-D. Munz*
- 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*

- INTRODUCTION TO MEASUREMENT TECHNIQUES  
(6-10 OCTOBER 2008)
- 35<sup>TH</sup> 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)
- PROBLEM SOLVING DEDICATED TO THE NUMERICAL APPROACH OF NANOPARTICLES (RTO-AVT-VKI)  
(9-13 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  
(16-20 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)
- ADVANCED HIGH TEMPERATURE INSTRUMENTATION FOR GAS TURBINE APPLICATIONS  
(11-15 MAY 2009)
- TURBULENT COMBUSTION  
(25-29 MAY 2009)

## OTHER CONFERENCES:

- PHYSMOD 2009: INTERNATIONAL WORKSHOP ON PHYSICAL MODELLING OF FLOW AND DISPERSION PHENOMENA  
(24-26 AUGUST 2009)
- 4<sup>TH</sup> SYMPOSIUM ON INTEGRATION CFD AND EXPERIMENTS IN AERODYNAMICS  
(7-9 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. **The fee for the researchers involved in the ADIGMA project is of 650 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.

## 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: .....

I am involved in the ADIGMA project

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

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 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 €

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