

Course Description

We offer a PhD course introducing advanced Discontinuous Galerkin Methods for solving Partial Differential Equations.

The course is offered with support from the DTU Informatics Graduate School (ITMAN) and the Danish Center for Applied Mathematics and Mechanics (DCAMM) at Technical University of Denmark.

The aim of the course is to give the students an introduction to discontinuous Galerkin methods (DG-FEM) for solving problems in the engineering and the sciences described by systems of partial differential equations. These methods, most appropriately considered as a combination of finite volume and finite element methods, have become widely used during the last decade as a powerful tool for the simulation of challenging problems in the sciences and engineering.

The PhD course covers both an overview of the theoretical properties of the methods, their efficient implementation, and more applied problems related to the multi-dimensional problems, unstructured grids and grid-generation, illustrated using Matlab. We shall draw on application examples and illustrations from electromagnetics, fluid and gas dynamics but the focus on the course is on understanding the methods in sufficient depth to apply them to a broad range of problems.

Course Homepage

<http://www2.imm.dtu.dk/~apek/DGFEMCourse2009/>

Organizers and Lecturers

Assistant Professor Allan P. Engsig-Karup
DTU Informatics
Technical University of Denmark.

Professor Jan. S. Hesthaven
Division of Applied Mathematics
Brown University

This course is offered as part of the activities of the DTU Informatics Graduate School ([ITMAN](#)) and of the DCAMM International Graduate Research School, see www.dcammm.dk.

Participants

The course is intended for PhD students and MSc students with a background in linear partial differential equations and methods for their numerical solution, e.g. equivalent to DTU course 02685.

Work Load

Approximately 70 scheduled hours (lectures, discussions and computer exercises) during the course and approximately 40 hours for the completion of an assignment problem after the duration of the course. Also, to prepare for the course it is required that participants read the first few chapters of the course literature.

Course Contents

The following topics will be covered in the course

1. Introduction
2. DG-FEM in one spatial dimension
3. Implementation and numerical aspects
4. Nonlinear problems
5. Extensions to two-dimensions
6. Grid generation
7. Higher-order operators
8. Three-dimensional problems and other advanced topics

See the course homepage for more details.

Course Literature

J.S. Hesthaven and T. Warburton (2008) Nodal Discontinuous Galerkin Methods: Algorithms, Analysis, and Applications. Springer Texts in Applied Mathematics 54, Springer Verlag, New York. XIV+500 pages.

Language

All lectures will be given in English.

Evaluation and Diplomas

To pass the course, active participation and the satisfactory completion of an assignment problem after the duration of the course are required. ETCS points: 5.

Registration

Ask for a registration form from the DCAMM-course secretariat, attn.: Kari Haugland, Department of Mathematics, Technical University of Denmark, Building 303S, DK-2800 Lyngby, Denmark. Tel.: (+45) 45253031, Fax: (+45) 45881399, E-mail: dcamm@mat.dtu.dk.

Registration Fee

There is no registration fee for students enrolled at universities and public research institutions. For researchers employed at universities and public research institutions the registration fee is €500. For all other participants the registration fee is €1500. Payment information will be given upon signing up for the course.

Deadline

The submitted request for registration must be received by the course secretariat no later than **August 1st, 2009**. Information on enrollment will be posted within a week after this date.

Lunch

ITMAN is sponsoring a daily lunch for participant of the course which are enrolled at universities and public research institutions.

Housing

There are a limited amount of rooms available on the premises of the Technical University of Denmark (DTU). These will be offered free of charge to students and otherwise at a cost of €25 per night. Accommodation in hotels/hotels can also be arranged by the participants themselves, see e.g. the Wonderful Copenhagen website at www.woco.dk and course webpage.

Scholarships

For PhD students enrolled at non-Danish universities and research institutions outside the EU, we can offer a limited

number of scholarships in order to facilitate participation, covering lodging (see above) and extra living costs with a per diem amount of €25. Travel expenses will not be covered. Your CV and a short letter of recommendation from your PhD supervisor should be sent in together with the registration form.

Internet Resources

For facts on the Technical University of Denmark and visitors' information: See <http://www.dtu.dk>. Information about teaching and research at DTU Informatics can be found at <http://www.imm.dtu.dk>, and for DCAMM at <http://www.dcamm.dk>.

About ITMAN

The DTU Informatics Graduate School ITMAN (IT MAN) administers the PhD program at DTU Informatics. ITMAN promotes cross-disciplinary research, matching information technology and mathematical modelling with other disciplines, often in collaboration with external collaborators: Other research institutions and private companies.

ITMAN is based on the idea of optimizing the relationship man - knowledge - IT as a key to growth for Danish companies in the global innovation and productivity competition. If one is to understand the role of IT, it is essential to view IT as more than "computers and software": IT is always a factor in the intricate net of machine, man and market.

ITMAN aims to strengthen research education through a series of initiatives: Specialized PhD courses and summer schools, quality assurance of supervision, PhD processes and procedures, research environment, implementation of a mentor program, help with IPR, social activities, etc.

About DCAMM

The Danish Center for Applied Mathematics and Mechanics, DCAMM is an informal framework for internationally oriented scientific collaboration between staff members at a number of departments at the Technical University of Denmark (DTU) and Aalborg University (AAU). The departments cooperating within DCAMM are:

- DTU Informatics
- DTU Mathematics
- DTU Mechanical Engineering
- Dept. of Civil Engineering, AAU
- Dept. of Mechanical Engineering, AAU

DCAMM is an informal construction. The day to day activities are coordinated by the secretary of the Center, while the formal governing body of DCAMM is the Scientific Council.

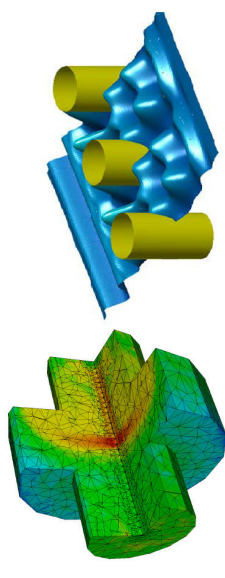
The DCAMM International Graduate Research School functions within the standard framework of the Ph.D.-education at the Technical University of Denmark (DTU) and at Aalborg University (AAU). Ph.D.-students associated to the School are full members of DCAMM through their departments and are enrolled in relevant Ph.D. programmes at DTU and AAU.

The School's role is to provide for an interdisciplinary framework for education of young researchers in an international research environment, and the activities are supported by Danish Agency for Research, Technology and Innovation (FI).

The Technical University of Denmark
DTU Informatics
Section of Scientific Computing

&

Danish Center for Applied Mathematics
and Mechanics



Ph.D.-course / Advanced school

An Introduction to
Discontinuous Galerkin Methods
for solving Partial Differential
Equations

Kgs. Lyngby, Denmark

17th-28th August, 2009

