

## ME 512 X Computational Fluid Dynamics (Spring 2011)

<b>Lecture</b>	Tuesday 1:30-3:45 pm, Tech. Building 116
<b>Instructor</b>	Dr. Junling (Joyce) Hu, Assistant professor Tech. 133 Tel: (203)576-4757 Email:jjhu@bridgeport.edu
<b>Office Hours</b>	Open door policy all day; scheduled office hours: Wednesday 2:30-4:30 pm and Thursday 10:00am-12:00pm

### Textbook

1. Jiyuan Tu, Guan Heng Yeoh, Chaoqun Liu, Computational Fluid Dynamics: A Practical Approach, Published by Butterworth-Heinemann, 2008. ISBN 0750685638, 9780750685634.
2. H.K. Versteeg and W. Malalasekera, An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Second Edition, Prentice Hall, 2007. ISBN 0131274988, 978-0131274983.

### References

1. S.V. Patankar, Numerical Heat Transfer and Fluid Flow, John Benjamins Publishing Co., 1980. ISBN 0891165223
2. John D. Anderson, Computational Fluid Dynamics, 1<sup>st</sup> Edition, McGraw-Hill, 1995. ISBN 0070016852.
3. Star-ccm+ user manuals and tutorials.
4. C.T. Shaw, Using Computational Fluid Dynamics, Prentice Hall, 1992. (free)

### Course Description

This course is intended as an introduction to the field of Computational Fluid Dynamics (CFD). Finite difference/finite volume methods will be introduced for solving Navier-Stokes and energy equations in heat transfer and fluid dynamics processes. This course will help students develop practical skills in Computational Fluid Dynamics and the use of commercial CFD packages, such as STAR-CCM+. Students will apply these skills to relevant engineering applications and gain an appreciation of the limitations and advantages of CFD modeling.

### Course Objectives

At the end of the course, a successful student should be able to:

1. Have a general appreciation of the nature of computational Fluid Dynamics techniques, such as the underlying differential equations, discretisation techniques, numerical solution algorithms and related factors controlling accuracy and stability.
2. Use a popular commercial software package to solve practical thermo-fluids problems and to have an awareness of the potential pitfalls in the use of such tools.
3. Understand and explain the thermo-fluids phenomena exhibited in the example applications and their practical applications
4. Communicate the results of their work, both orally and in formal written reports.

### Course Outline

1. Philosophy of computational fluid dynamics

2. The governing equations of fluid dynamics
3. Mathematical behavior of partial differential equations
4. Introduction to finite difference and finite volume methods
5. Diffusion problems
6. Convection-diffusion problem
7. Pressure correction, SIMPLE-like method
8. Grid generation and post processing
9. Introduction to turbulent flows and modeling of turbulence
10. Introduction to commercial CFD package: Star-ccm+

### **Grading**

Quiz/homework	20%	Mid-term exam	20%
Final exam	20%	Project/participation	40%

### **Grading Policy**

Homework – Homework problems will be assigned in class and usually you are allowed to finish them in a week. You are encouraged to work in groups. Homework will be assigned and solution will be given in Blackboard. Randomly, you will be called to explain your homework at the beginning of the class. If you do not come to class or intentionally avoid explaining your homework in class, your homework grade will be considered as 0.

Quiz – In-class quizzes will be given throughout the semester to encourage students to keep up-to-date with the material, and to ensure that the lectures are effective. The quizzes will be based on the homework assignments and class lectures. They will take approximately 10 minutes. They might be given at the beginning of a class or at the end of a class. No provision will be made to make-up any quiz. If you miss a quiz, you will receive a 0 grade for that one.

Exams – Mid-term and final exams will cover material from the lectures and homework. Make-up exams may be given to those students who submit a written request to the instructor no less than 3 days prior to the exam. Emergency or unexpected issues related to make-up exams will require proper documentation.

Projects – Projects involve detailed simulation of flow problems. You may choose from a list of projects that have already been identified, or, with instructor approval, you may create your own project. Your final project report will include citation of relevant literature, and a report summarizing the results of the detailed analysis you performed. Each student will give a brief presentation on their project to the entire class.

### **Code of Conduct**

You are responsible for keeping up to date with the course materials posted on the Blackboard site: <http://blackboard.bridgeport.edu/>

You are expected to attend class during the scheduled times, except in unusual circumstances. You will not be able to keep up with the class if you do not attend.

It is the student's responsibility to familiarize himself or herself with and adhere to the standards set forth in the policies on cheating and plagiarism as defined in Chapters 2 and 5 of the Key to UB <http://www.bridgeport.edu/pages/2623.asp> or the appropriate graduate program handbook.

**Note**

I reserve the right to make adjustments to the syllabus during the semester.