UUT 514E Computational Fluid Dynamics
Aerospace Engineering Graduate Program
Spring 2007/08

Thursday 14:00-16:50, D-110

Asst. Prof. Selman Nas
Room: UUB 333, Phone: 285-3106
E-mail: nas@itu.edu.tr

Office Hour: Friday between 14:30-15:30 or by appointment

Text Book: Computational Fluid Mechanics and Heat Transfer, by J.C.Tannehill, D.A.Anderson and R.H.Pletcher , 2nd edition, Taylor and Francis (1997)

Topics to be covered (Tentative):

Introduction (Chapter 1 and 2) (2 Lectures)
Fluid mechanical topics and a review of PDEs

Basics of Discretization Methods (Chapter 3) (5 Lectures)
Finite differences, finite difference representaion of PDEs, numerical errors, consistency, stability and convergence, Fourier or Von Neumann analysis

Hyperbolic Systems of PDEs (Chapters 4 and 6) (8 Lectures)
Explicit and implicit schemes, numerical dissipation and dispersion, modern schemes for the hyperbolic equations, treatment of boundary conditions, complex geometries and finite volume formulation.

Elliptic and Parabolic Equations (Chapters 4, 7 and 8) (6 Lectures)
Explicit and implicit schemes for the heat equation (parabolic equations), Laplace equation (elliptic equations), iterative methods and convergence acceleration techniques.

Numerical Metods for Navier-Stokes Equations (Chapter 9) (5 Lectures) Explicit MacCormack method, Beam-Warming scheme, Upwind methods, pressure correction algorithms.

Complex Geometries (Chapters10) (2 Lectures)
Structured and unstructured grid systems and grid generation techniques.

Tests:

All assaingments and exams may require programming on a digital computer using a high-level programming language such as Fortran, C or MATLAB.

Grading: One midterm: %30, Homework and projects: %35, final exam: %35

References:

Hirsh, Charles *Numerical Computation of Internal and External Flows Volume 1 and Volume 2,* John Wiley and Sons, 1987
Hoffmann K.A, Chiang S.T. *Computational Fluid Dynamics Volume 1, Volume 2 and Volume 3,* Enginnering Education System, 2000
Chung T.J. *Computational Fluid Dynamics,* Cambridge University Press, 2002 Lomax H, Pulliam T.H. *Fundamentals of Computational Fluid Dynamics,* 1999
Numerical Methods for Conservation Laws, *Lectures in Mathematics, by R.J. LeVeque, Birkhauser Verlag (1990)*
Computational Methods for Fluid Dynamics, *by J. H. Ferziger and M. Peric Springer Verlag. Berlin Heidelberg, (1996)*