

| |
|---|
| Area: Hydraulic, Water Resources and Environmental Engineering |
| Level: PhD |
| Course title: Computational Fluid Dynamics |
| Course advisor: M. Spasojevic |
| <p>Course objective: Gain theoretical background and practical experience in development and application of mathematical models in the area of fluid mechanics.</p> |
| <p>Course outline</p> <p><i>Course topics</i> Governing equations of fluid mechanics, advantages of computational fluid dynamics Classification of partial differential equations – different approaches Type of equations, initial and boundary conditions Fundamentals of discretization techniques Consistency, stability, convergence, Von Neumann's stability analysis Numerical techniques for hyperbolic PDE's - advection Example: Inviscid Burger equation Review of classical FDM schemes, artificial dissipation Numerical techniques for parabolic and elliptic PDE's - diffusion Iterative methods for solving algebraic equations systems Solution of simplified equations – viscous Burger equation Solution of complete equations for incompressible flows Older approaches – non-primitive variable formulations Primitive-variable formulations Pressure-Poisson equation methods (PPE) MAC (Marker and Cell) type methods; Staggered versus non-staggered grid; Fractional-step methods; SIMPLE and SIMPLER methods; PISO methods Artificial Compressibility (AC) methods Brief overview of compressible flow solutions</p> <p><i>Assignments and term projects</i> Course topics are accompanied by assignments and term projects, requiring individual work under advisor's guidance and supervision.</p> |
| <p>Recommended literature:</p> <ol style="list-style-type: none"> 1. J. H. Ferziger and M. Perić: <i>Computational Methods for Fluid Dynamics</i>, 3rd Edition, Springer, New York, 2002. 2. C. A. J. Fletcher: <i>Computational Techniques for Fluid Dynamics</i>, Vol. I & II, 2nd Edition, Springer, Berlin, 1991. 3. C. Hirsch: <i>Numerical Computation of Internal and External Flows</i>, Vol. I & II, Wiley, New York, 1991. 4. S. V. Patankar: <i>Numerical Heat Transfer and Fluid Flow</i>, McGraw-Hill New York, 1980. 5. R. D. Richtmyer and K. W. Morton: <i>Difference Methods for Initial-Value Problems</i>, John Wiley & Sons, 2nd, 1967. 6. F. Sotiropoulos, <i>Computational Fluid Dynamics and Heat Transfer</i>, Class Notes, IIHR, 1993. |