MM3151

Study program / course: Mechanical Engineering

Type and level of study: Master academic studies

Course: Computational Fluid Dynamics CFD

Lecturers: Nenad D. Filipovic, Slobodan Savic

Status of course: Elective for module M_5, III semester

Number of ECTS: 6

Precondition: Mechanics I, Mechanics II, Mathematics I, Mathematics II, Fluid mechanics, Thermodynamics

The objective of course

Objective of course is introducing of students with basic CFD principles, mixed, penalty and explicit formulation of fluid flow field, finite element methods, finite difference method, Taylor-Galerkin method for unsteady fluid flow, UPWIND technique, TAYLOR-GALERKIN method and coupled problem solving fluid-structure interaction.

The outcome of course

After this course and final exam from CFD, students will be able to understand the contents of courses which rely on the basic field calculation and to participate into the scientific studies which rely on this scientific area. Student will get the knowledge from this course in basic numerical methods for fluid flow field, solving coupled problem fluid-structure interaction as well as using parallel computing for large scale calculation in fluid flow problems.

Syllabus

Theoretical study

Introduction and basic principles in CFD. Mixed formulation (velocity-pressure). Penalty formulation and explicit formulation. Numerical solving of fluid mechanics by finite difference method. Taylor-Galerkin method for unsteady fluid flow. UPWIND techniques in multidimensional space. TAYLOR-GALERKIN method. Strong coupling of fluid-structure problems. Loose coupling of fluid-structure interaction problems. ALE formulation. Explicit-implicit algorithms. Turbulent models in CFD. Numerical solving of boundary layer problems. Compressible flow problems. Parallel processing in CFD.

Practical classes Practices, Research study.

Recommended reading

1. Kojic, M., Slavkovic, R., Zivkovic, M., Grujovic, N., Finite element methods I, Linear analysis, Faculty of Mechanical Engineering, 1998.
2. Bathe, K.J., (1982) *Finite Element Procedures in Engineering Analysis*, Prentice-Hall, Inc., Englewood Clis, New Jersey

The number of hours of active teaching:				Other classes:
Theory: 3	Practical classes: 1.4	Other forms of teaching: 0.6	Research study: 0	1

Methods of teaching

Evaluation of knowledge

Pre-final exam obligations	points	Final exam	points
Activities during the classes:	**5**		
Practical classes:			
Colloquiums(s) :	**65**	**Final exam**	**30**
Seminar(s) :			