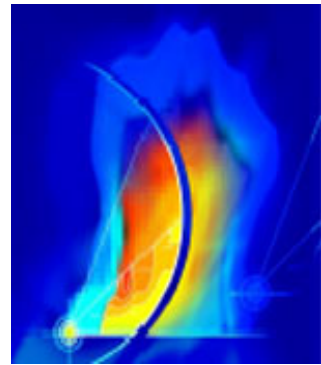# Computational Fluid Dynamics

Vorlesung: Monday, 9-11, Online

Übung: Tuesday, 13-15, Online

1. Contents of lecture course

N	Subject	Deadline	Tutor
1	Finite Difference method, FDM. Boundary conditions. Chapters 2 and 3 [1].	10.10.22	Kornev
2	Stability and artificial viscosity of numerical methods Chapter 4 [1].	17.10.22	Kornev
3	Solution of Navier-Stokes equations using FDM. Simple explicit time advance scheme. Staggered grid. Chapter 5	24.10.22	Kornev
4	Solution of Navier-Stokes equations using FDM. Simple explicit time advance scheme. Staggered grid. Chapter 6.	07.11.22	Kornev
5	Finite volume method (FVM). Navier Stokes Equation. Pressure and unsteady terms. Chapter 7	14.11.22	Kornev
6	FVM. Advection terms. Explicit scheme. Chapter 7	21.11.22	Kornev
7	Pressure correction method SIMPLE. Pressure correction method PISO Chapter 7	28.11.22	Kornev
8	Rhie Chow Interpolation	05.12.22	Kornev
9	Grids. Chapter 9	12.12.22	Kornev
10	VOF Methods. Free surface problems.	19.12.22	Kornev
11	Application of CFD. Samples from the Ship Hydromechanics	09.01.23	Kornev
12	Grid free methods.	16.01.23	Kornev
13	Overview of the course	23.01.23	Kornev

2. Contents of exercises on the theory. Asad Yamin

N	Subject	Deadline
1	Numerical integration using rectangle rule, trapezoid rule, Simpson rule, Gauß quadratures, Programming.	11.10.22
2	Numerical solution of a simple ordinary differential equation: Euler method, Runge Kutta Method. Explicit versus implicit. Programming	18.10.22
3	Solution of systems of linear equations	25.10.22
4	Solution of Poisson equations	01.11.22

3. Contents of OpenFOAM exercises. Asad Yamin

5	Finite difference method for a generic equation	08.11.22
6	Basic Linux commands (cd, ls, using tab to complete input, rm, mv, ...). Running simple tutorials / opening cases with paraFoam	15.11.22
7	OpenFOAM case structure. Running cases. ParaFoam for tutorial cases.	22.11.22
8	BlockMesh utility. Generation of cavity geometry from scratch. Setting up cases (BC's, IC's, schemes, fluid parameters). Running the case / visualize by paraFoam. Modification of cavity (optional)	29.11.22
9	Finite volume methods for a generic equaton	06.12.22
10	Different ways of increasing the accuracy: varying the mesh resolution, changing the scheme order. Connection to finite volume method. Changing turbulence models	13.12.22
11	OpenFOAM exercise – answering questions regarding the assignment	20.12.22
12	OpenFOAM exercise – answering questions regarding the assignment	10.01.23
13	How to write report on assignment?	17.01.23
14	OpenFOAM exercise – answering questions regarding the assignment	24.01.23