Training Department

OpenFOAM Workshops

From an introductory to advanced level

Level 1: Introductory (for beginners)

Level 2: Lagrangian Approach

Level 3: Geometry and Mesh Generation

Level 4: Turbulence Modelling

Level 5: Advanced Coding

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OpenFOAM workshop; L1 (introductory)

Duration: 6 days (24 hours)

Topics

- **Introduction**
  - Pros and cones of OpenFOAM
  - Why we are using CFD
    - Complexity of PDE's
    - A brief introduction on CFD
  - General structure of OpenFOAM
  - First example: Cavity!
- **Introduction to Geometry and Mesh generation in OpenFOAM**
  - Mesh Types
  - Mesh Quality
  - Mesh Independence
  - Different ways to create mesh in OpenFOAM
    - blockMesh
    - snappyHexMesh

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OpenFOAM workshop; L1 (introductory)

Duration: 6 days (24 hours) - Continue

Topics

- **Essential options**
  - controlDict
  - Simple Initial Condition
  - Simple Boundary Condition
  - damBreak
  - setFields
  - Professional Boundary Conditioners
  - swak4Foam
  - Turbulence
  - Multiphase
  - Non-Newtonian
  - Porous Media
  - Introduction to FVM Schemes
  - Parallel Processing
- **Post Processing**

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OpenFOAM workshop; L1 (introductory)

Duration: 6 days (24 hours) - Continue

Topics

- **Post Processing (with Paraview)**
  - Streamline
  - Clip
  - Glyph
  - Threshold
  - Contour
  - Integrate Variable
  - Post processing functions
  - Calculator
  - LES Quality Check

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Lagrangian Particle Tracking; L2

Duration: 3 days (12 hours)

Topics

- **Introduction**
  - Different Types of flows
  - Forces on Particles
  - Governing Equations
  - Types of coupling
- **LPT in OpenFOAM**
  - Introduction on simple case setup in OpenFOAM
  - Run the case with pimpleParcelFoam
  - Needed inputs for LPT with pimpleParcelFoam
  - Different solvers for LPT in OpenFOAM
  - Some examples
  - Modification of postProcessing tools

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Geometry and Mesh generation; L3

Duration: 6 days (18 hours)

Topics

- **Introduction**
- **Mesh Quality**
  - Structured Vs Unstructured Mesh
  - Orthogonality
  - Skewness
  - Aspect Ratio
  - Smoothness
- **blockMesh**
- **Creating Geometry in Catia**
- **Mesh generation with 3-matic and HyperMesh**
- **snappyHexMesh**
- **SALOME**
  - structured mesh
  - unstructured mesh without boundary layer
  - Unstructured mesh with boundary layer
  - Coupling between SALOME and snappyHexMesh

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Geometry and Mesh generation; L3

Duration: 6 days (18 hours)-continue

Topics

- **ICEM**
  - Structured Vs Unstructured Mesh
  - Geometry Creation
  - ICEM Meshing Process
  - 2D Hex. Mesh
  - Mesh Projection
  - O-Grid Block
  - 3D Hex. Mesh

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Turbulence Modeling In OpenFOAM; L4

Duration: 6 days (18 hours)

Topics

- **Introduction**
  - The oldest unsolved problem in physics
  - Some examples
  - Transition from laminar to turbulent flow
  - Turbulent flow features
  - Why turbulent flow is challenging?
- **All the turbulence models in OpenFOAM (Overview)**
  - Laminar
  - RANS
  - URANS
  - SAS
  - DES
  - LES
  - DNS
- **RANS Models in detail**
  - Spalart-Allmaras
  - Standard k-epsilon
  - kOmegaSST
  - SSG
  - kOmega
  - LienLeschziner

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Turbulence Modeling In OpenFOAM; L4

Duration: 6 days (18 hours) - continue

Topics

- **Large-Eddy Simulation of Turbulent Flows**
  - Filtering Operation
  - Filtered Equations
  - SGS Modeling
    - Static (standard) Smagorinsky
    - Dynamic Smagorinsky
    - Dynamic Lagrangian
    - Dynamic Bardina
    - WALE
    - Dynamic k-Equation
- **RANS test case (pitzDaily)**
  - Mesh Generation
  - How to choose turbulence model
  - Initial and Boundary Conditions
  - Turbulence Statistics
  - Post Processing

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Turbulence Modeling In OpenFOAM; L4

Duration: 6 days (18 hours) - continue

Topics

- **LES test case (Channel395)**
  - Mesh Generation
  - Initial and Boundary Conditions
  - LES Quality Check
  - Post Processing
- **From Laminar to turbulent in an Example**
  - How to setup s k-epsilon model
  - Change a model to another one
  - Detailed description of wall functions
  - Using MapFields
  - Initialization of LES modeling with k-epsilon

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Advanced Coding In OpenFOAM; L5

Duration: 6 days (18 hours)

Topics

- **Introduction (A review on OpenFOAM structure)**
- **Basics Of C++**
  - Basic IO!
  - Data Types
  - Scope of Variables
  - If, else, else if
  - While, do while
  - For
  - Functions
  - Arrays
  - Pointers
  - Namespace
  - Typedef
  - Class
  - Templates
  - Shared Libs.

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Advanced Coding In OpenFOAM; L5

Duration: 6 days (18 hours) -continue

Topics

- **C++ in OpenFOAM**
  - Basic Tensor Classes
  - Algebraic Tensor Operations
  - Dimensional Units in OpenFOAM
  - List and Fields
  - polyMesh and fvMesh
  - geometricFields
  - volFields
  - forAll
  - Equation Discretization
  - Wmake
  - Extra C++
- **New BC (Advanced Boundary Conditions)**
- **New IC1**
- **New IC2.**
- **Adding a new Integration Scheme.**
- **New post-Processing Function**
- **Creating New Multiphase Solver**

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