

Spoken Tutorial

Introduction to OpenFOAM

Talk to a Teacher

<http://www.sakshat.ac.in>

National Mission on Education through ICT

<http://spoken-tutorial.org>

Rahul Joshi and Saurabh Sawant

Date: August 13, 2019



Talk to a Teacher

About OpenFOAM

Open Source Field Operation and Manipulation:



Talk to a Teacher

About OpenFOAM

Open Source Field Operation and Manipulation:

- is an Open Source Computational Fluid Dynamics Software



Talk to a Teacher

About OpenFOAM

Open Source Field Operation and Manipulation:

- is an Open Source Computational Fluid Dynamics Software



Talk to a Teacher

About OpenFOAM

Open Source Field Operation and Manipulation:

- is an Open Source Computational Fluid Dynamics Software



Talk to a Teacher

About OpenFOAM

CFD tool box:



Talk to a Teacher

About OpenFOAM

CFD tool box:

- written in C++ working on Linux operating systems



Talk to a Teacher

About OpenFOAM

CFD tool box:

- written in C++ working on Linux operating systems



Talk to a Teacher

About OpenFOAM

CFD tool box:

- written in C++ working on Linux operating systems



Talk to a Teacher

About OpenFOAM

OpenFOAM:



Talk to a Teacher

About OpenFOAM

OpenFOAM:

- has an Object Oriented Programming Interface



Talk to a Teacher

About OpenFOAM

OpenFOAM:

- has an Object Oriented Programming Interface



Talk to a Teacher

About OpenFOAM

OpenFOAM:

- has an Object Oriented Programming Interface
- It is licensed under GNU General Public Licence



Talk to a Teacher

About OpenFOAM

OpenFOAM:

- has an Object Oriented Programming Interface
- It is licensed under GNU General Public Licence



Talk to a Teacher

About OpenFOAM

OpenFOAM:

- has an Object Oriented Programming Interface
- It is licensed under GNU General Public Licence



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- is a *Finite Volume* based CFD software



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- is a *Finite Volume* based CFD software



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- is a *Finite Volume* based CFD software
- using both structured and unstructured grid



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- is a *Finite Volume* based CFD software
- using both structured and unstructured grid



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- is a *Finite Volume* based CFD software
- using both structured and unstructured grid



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh
 - It is useful for structured meshing ,easy and smaller grids



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh
 - It is useful for structured meshing ,easy and smaller grids



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh
 - It is useful for structured meshing ,easy and smaller grids
 - mesh input is in form of a script and not a GUI



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh
 - It is useful for structured meshing ,easy and smaller grids
 - mesh input is in form of a script and not a GUI



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh
 - It is useful for structured meshing ,easy and smaller grids
 - mesh input is in form of a script and not a GUI
- It also has an Advanced Meshing tool called as : snappyHexMesh



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh
 - It is useful for structured meshing ,easy and smaller grids
 - mesh input is in form of a script and not a GUI
- It also has an Advanced Meshing tool called as : snappyHexMesh



Talk to a Teacher

OpenFOAM Capabilities

OpenFOAM:

- has a mesh generation tool called as blockMesh
 - It is useful for structured meshing ,easy and smaller grids
 - mesh input is in form of a script and not a GUI
- It also has an Advanced Meshing tool called as : snappyHexMesh



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - **fluentMeshToFoam**



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - fluentMeshToFoam



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - fluentMeshToFoam
 - cfxToFoam



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - fluentMeshToFoam
 - cfxToFoam



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - fluentMeshToFoam
 - cfxToFoam
- useful for large and complex geometries



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - fluentMeshToFoam
 - cfxToFoam
- useful for large and complex geometries



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - fluentMeshToFoam
 - cfxToFoam
- useful for large and complex geometries
- arbitrary polyhedral mesh



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - fluentMeshToFoam
 - cfxToFoam
- useful for large and complex geometries
- arbitrary polyhedral mesh



Talk to a Teacher

Importing Mesh Files

- We can import mesh files into openFOAM using third party softwares like
 - fluentMeshToFoam
 - cfxToFoam
- useful for large and complex geometries
- arbitrary polyhedral mesh



Talk to a Teacher

Boundary Conditions

- **Various default boundary conditions which are available**



Talk to a Teacher

Boundary Conditions

- **Various default boundary conditions which are available**



Talk to a Teacher

Boundary Conditions

- **Various default boundary conditions which are available**
- **Users can also modify the boundary conditions according to their case**



Talk to a Teacher

Boundary Conditions

- **Various default boundary conditions which are available**
- **Users can also modify the boundary conditions according to their case**



Talk to a Teacher

Boundary Conditions

- **Various default boundary conditions which are available**
- **Users can also modify the boundary conditions according to their case**



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)



Talk to a Teacher

- Incompressible flows (icoFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)
- Particle-tracking flows (coalChemistryFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)
- Particle-tracking flows (coalChemistryFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)
- Particle-tracking flows (coalChemistryFoam)
- Molecular Dynamics (mdFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)
- Particle-tracking flows (coalChemistryFoam)
- Molecular Dynamics (mdFoam)



Talk to a Teacher

Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)
- Particle-tracking flows (coalChemistryFoam)
- Molecular Dynamics (mdFoam)
- MHD flows (mhdFoam), etc



Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)
- Particle-tracking flows (coalChemistryFoam)
- Molecular Dynamics (mdFoam)
- MHD flows (mhdFoam), etc



Solvers

- Incompressible flows (icoFoam)
- Compressible flows (sonicFoam)
- Multiphase flows (interFoam)
- Combustion (chemFoam)
- Particle-tracking flows (coalChemistryFoam)
- Molecular Dynamics (mdFoam)
- MHD flows (mhdFoam), etc



Solvers

- Users can create their own solvers



Talk to a Teacher

- Users can create their own solvers



Talk to a Teacher

Solvers

- Users can create their own solvers
- Modify the existing solvers



Talk to a Teacher

Solvers

- Users can create their own solvers
- Modify the existing solvers



Talk to a Teacher

Solvers

- Users can create their own solvers
- Modify the existing solvers



Talk to a Teacher

Parallel Processing

- Parallel processing is easy in OpenFOAM and it supports Open MPI



Talk to a Teacher

Parallel Processing

- **Parallel processing is easy in OpenFOAM and it supports Open MPI**



Talk to a Teacher

Parallel Processing

- Parallel processing is easy in OpenFOAM and it supports Open MPI
- We can use 'n' number of processors



Talk to a Teacher

Parallel Processing

- **Parallel processing is easy in OpenFOAM and it supports Open MPI**
- **We can use 'n' number of processors**



Talk to a Teacher

Parallel Processing

- **Parallel processing is easy in OpenFOAM and it supports Open MPI**
- **We can use 'n' number of processors**



Talk to a Teacher

Post Processing

- OpenFOAM results can be visualized using Paraview which is an open source software



Talk to a Teacher

Post Processing

- **OpenFOAM results can be visualized using Paraview which is an open source software**



Talk to a Teacher

Post Processing

- OpenFOAM results can be visualized using Paraview which is an open source software
- OpenFOAM results can also be visualised in other softwares like



Talk to a Teacher

Post Processing

- OpenFOAM results can be visualized using Paraview which is an open source software
- OpenFOAM results can also be visualised in other softwares like



Talk to a Teacher

Post Processing

- OpenFOAM results can be visualized using Paraview which is an open source software
- OpenFOAM results can also be visualised in other softwares like
 - Tecplot



Talk to a Teacher

Post Processing

- OpenFOAM results can be visualized using Paraview which is an open source software
- OpenFOAM results can also be visualised in other softwares like
 - Tecplot



Talk to a Teacher

Post Processing

- OpenFOAM results can be visualized using Paraview which is an open source software
- OpenFOAM results can also be visualised in other softwares like
 - Tecplot
 - Ensignt



Talk to a Teacher

Post Processing

- OpenFOAM results can be visualized using Paraview which is an open source software
- OpenFOAM results can also be visualised in other softwares like
 - Tecplot
 - Ensign



Talk to a Teacher

Post Processing

- OpenFOAM results can be visualized using Paraview which is an open source software
- OpenFOAM results can also be visualised in other softwares like
 - Tecplot
 - Ensignt



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**
 - **Fluent**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**
 - **Fluent**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**
 - **Fluent**
 - **CFX**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**
 - **Fluent**
 - **CFX**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**
 - **Fluent**
 - **CFX**
 - **StarCCm+**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**
 - **Fluent**
 - **CFX**
 - **StarCCm+**



Talk to a Teacher

Equivalent to commercial software

- **Commercial softwares are costly and source code is not available**
- **Solver capabilities of OpenFOAM are similar to that of**
 - **Fluent**
 - **CFX**
 - **StarCCm+**



Talk to a Teacher

Modelling in OpenFOAM

Solver syntax in OpenFOAM:



Talk to a Teacher

Modelling in OpenFOAM

Solver syntax in OpenFOAM:

- is similar to that used in writing a Partial Differential Equation



Talk to a Teacher

Modelling in OpenFOAM

Solver syntax in OpenFOAM:

- is similar to that used in writing a Partial Differential Equation



Talk to a Teacher

Modelling in OpenFOAM

Solver syntax in OpenFOAM:

- is similar to that used in writing a Partial Differential Equation



Talk to a Teacher

Forum to answer questions

- Do you have questions on **THIS Spoken Tutorial?**



Talk to a Teacher

Forum to answer questions

- Do you have questions on **THIS Spoken Tutorial?**
- Choose the minute and second where you have the question.



Talk to a Teacher

Forum to answer questions

- Do you have questions on THIS Spoken Tutorial?
- Choose the minute and second where you have the question.
- Explain your question briefly.



Talk to a Teacher

Forum to answer questions

- Do you have questions on **THIS Spoken Tutorial?**
- Choose the minute and second where you have the question.
- Explain your question briefly.
- Someone from the **FOSSEE team** will answer them. Please visit



Talk to a Teacher

Forum to answer questions

- Questions not related to the Spoken Tutorial?
- Do you have general / technical questions on the Software?
- Please visit the FOSSEE Forum
<http://forums.fossee.in/>
- Choose the Software and post your question.



Talk to a Teacher

Case Study Project

- The FOSSEE team coordinates solving past, current or new CFD projects using OpenFOAM
- We give honorarium and certificate to those who do this

For more details, please visit this site:

<http://cfd.fossee.in/>



Talk to a Teacher

Acknowledgements

- Spoken Tutorial Project is a part of the Talk to a Teacher project
- It is supported by the National Mission on Education through ICT, MHRD, Government of India
- More information on this Mission is available at:

<http://spoken-tutorial.org/NMEICT-Intro>



Talk to a Teacher

Acknowledgements

- Spoken Tutorial Project is a part of the Talk to a Teacher project
- It is supported by the National Mission on Education through ICT, MHRD, Government of India
- More information on this Mission is available at

<http://spoken-tutorial.org/NMEICT-Intro>



Talk to a Teacher

About the Contributor

- **Rahul Joshi - IIT BOMBAY**
signing off.
- **Thanks for joining.**



Talk to a Teacher