# FLUENT - Flow over an Airfoil- Step 4

- Problem Specification 1. Create Geometry in GAMBIT 2. Mesh Geometry in GAMBIT 3. Specify Boundary Types in GAMBIT 4. Set Up Problem in FLUENT 5. Solve! 6. Analyze Results
- 7. Refine Mesh
- Problem 1
- Problem 2

# Step 4: Set Up Problem in FLUENT

# Launch FLUENT

#### Start > Programs > Fluent Inc > FLUENT 6.3.26

Select 2ddp from the list of options and click Run.

# Import File

Main Menu > File > Read > Case ...

Navigate to your working directory and select the airfoil.msh file. Click OK.

The following should appear in the FLUENT window:



Check that the displayed information is consistent with our expectations of the airfoil grid.

# **Analyze Grid**

Grid > Info > Size

How many cells and nodes does the grid have?

#### Display > Grid

Note what the surfaces farfield1, farfield2, etc. correspond to by selecting and plotting them in turn.

Zoom into the airfoil.

Where are the nodes clustered? Why?

#### **Define Properties**

Define > Models > Solver...

Under the Solver box, select Pressure Based.

🖴 Solver	
Solver	Formulation
Pressure Based     Density Based	C Explicit
Space	Time
2D     Axisymmetric     Axisymmetric Swirl     3D	<ul> <li>General Steady</li> <li>C Unsteady</li> </ul>
Velocity Formulation	
Gradient Option	Porous Formulation
<ul> <li>Green-Gauss Cell Base</li> <li>Green-Gauss Node Bas</li> <li>Least Squares Cell Bas</li> </ul>	d © Superficial Velocity ed Physical Velocity
OK Ca	ncel Help

#### Click OK.

Define > Models > Viscous

Select Inviscid under Model.

•	Inviscid
c	Laminar
C	Spalart-Alimaras (1 eqn)
C	k-epsilon (2 eqn)
C	k-omega (2 eqn)
C	Reynolds Stress (5 eqn)

#### Click OK.

# Define > Models > Energy

The speed of sound under SSL conditions is 340 m/s so that our freestream Mach number is around 0.15. This is low enough that we'll assume that the flow is incompressible. So the energy equation can be turned off.

Make sure there is no check in the box next to *Energy Equation* and click *OK*.

#### Define > Materials

Make sure air is selected under Fluid Materials. Set Density to constant and equal to 1.225 kg/m<sup>3</sup>.

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Name		Material Type	Order Materials By
air		fluid	• 🕫 Name
Chemical Formula		Fluid Materials	C Chemical Formula
		air	Database
Properties			
Density (kg/m3)	constant	• Edi	
	1.225		-
Char	nge/Create	Delete Close	Help

#### Click Change/Create.

# Define > Operating Conditions

We'll work in terms of gauge pressures in this example. So set Operating Pressure to the ambient value of 101,325 Pa.

Pressure	Gravity
Operating Pressure (pascal) 101325 Reference Pressure Location X (m) 0	Gravity
Y (m) 0 OK Cancel H	lelp

### Click OK.

#### Define > Boundary Conditions

Set *farfield1* and *farfield2* to the *velocity-inlet* boundary type.

For each, click Set.... Then, choose *Components* under *Velocity Specification Method* and set the x- and y-components to that for the freestream. For instance, the x-component is 50\*cos(1.2)=49.99. (Note that 1.2° is used as our angle of attack instead of 2° to adjust for the error caused by assuming the airfoil to be 2D instead of 3D.)

PM   Multiphase   UDS
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# Click OK.

Set farfield3 to pressure-outlet boundary type, click Set... and set the Gauge Pressure at this boundary to 0. Click OK.

Go to Step 5: Solve!

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