# Supersonic Flow Over a Wedge - Numerical Results (FPP)

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This page goes through the post-processing steps for the Supersonic Flow Over a Wedge in the classic FLUENT post-processor. For instructions on performing the post-processing using the newer CFD Post post-processor included in ANSYS Workbench, see this page.

## Numerical Results (in FLUENT Post-Processor)

#### **Velocity Vectors**

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First, let's take a look at the velocity vectors. In the Outline window, under Results select Colors and Animations. In the Colors and Animations window, under Graphics, select Vectors. Then press Set Up....

In the Vectors window that opens, change the Scale of the arrows to 0.25, and change the Color by parameter to Velocity... Mach Number

<b>Vectors</b>	<b>X</b>					
Options	Vectors of					
	Velocity -					
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	Color by					
Auto Scale	Velocity 👻					
Draw Mesh	Mach Number 👻					
Style	Min Max					
arrow	2.202247 3					
Scale Skip	Surfaces					
.25 0	farfield					
	interior-surface_body					
Vector Options	surface_body					
Custom Vectors	symmetry wedge					
Custom vectors	wedge					
Surface Name Pattern						
Match	New Surface 💌					
	Surface Types					
	axis					
	dip-surf					
	exhaust-fan					
Display Compute Close Help						

Hit Display to view the vectors in the graphics window

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2.84e+00	t
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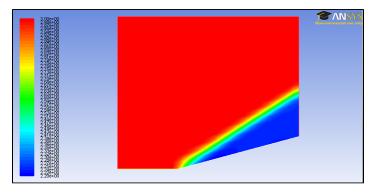
Once you have plotted the velocity vectors, you may close the Vectors menu.

#### **Mach Number Contours**

Next, we will plot the contours of mach number. In the *Graphics and Animations* window under \_Graphics, select *Contours*, and press *Set Up...*. Change the *Contours Of* parameter to *Velocity... Mach Number*. Next, check the box next to *Filled*.

Contours				
Options	Contours of			
▼ Filled	Velocity	•		
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Clip to Range	2,203597			
Draw Profiles				
Draw Mesh	Surfaces			
	farfield			
Levels Setup	interior-surface_body surface_body			
50 🚔 1	symmetry			
	wedge			
Surface Name Pattern				
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	Surface Types			
	axis clip-surf	<u> </u>		
	exhaust-fan			
	fan	<b>T</b>		
Display Compute Close Help				

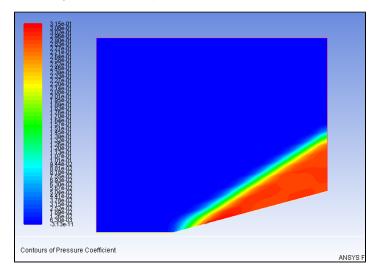
Change the Levels to 50 and press Display





### **Pressure Coefficient/ Static Pressure Contours**

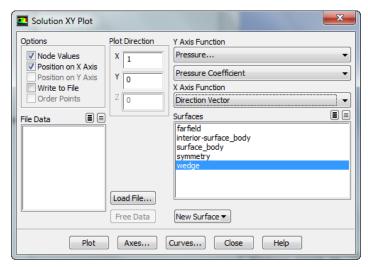
Now, change the Contours Of parameter to Pressure... Pressure Coefficient and press Display.



Next, change the *Contours Of* parameter to *Pressure... Static Pressure* and press *Display*. When you have plotted the contours of static pressure, you may close the *Contours* window. Again, use the *print information* tool to view the pressure behind the shock. I received the range (282041.19, 286057.13). The average of this range is about 2.803 atmospheres. From the analytical solution, we found that the pressure behind the shock is about 2.824, a 0.7% difference.

#### Pressure Coefficient Along Wedge

In the Outline window under Results, select Plots. In the Plots window, select XY plot and press Set Up.... Change the Y Axis Function to Pressure... Pressure Coefficient, and select the Wedge under Surfaces.



To see the plot, press *Plot* 

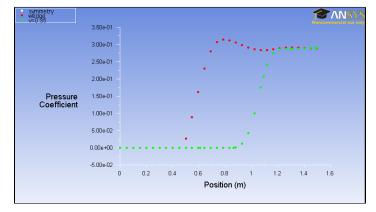
• wedge												ISY
	3.50e-01											
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_	2.00e-01											
Pressure Coefficient	1.50e-01											
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	5.00e-02											
	0.00e+00											
	0.5	0.6	0.7	0.8	0.9 Po	1 sition	1.1 (m)	1.2	1.3	1.4	1.5	
Pressure Coefficient								AN	SYS FLUE	ENT 13.0	Feb 23 I (2d, dp, dbr	3, 2012 is imp)

#### **Measure Shock Angle**

To measure the shock angle, we first need to create a line that we can plot the coefficient of pressure over. In the Solution XY Plot window, click New Surface > Line/Rake. We will arbitrarily use the line, y = 0.35. Set the start point of the line as (0,0.35), and the end point of the line as (1.5,0.35). Name the line y = 0.35. Now press Create

Line/Rake Surface	<b>— X</b> —				
Options Type Line Tool Reset	Number of Points				
End Points					
x0 (m)	x1 (m) 1.5				
y0 (m) .35	y1 (m) .35				
z0 (m) 0	z1 (m) 0				
Select Points with Mouse					
New Surface Name					
y=0.35					
Create Manage	Close Help				

Now, the new surface will appear in the list of surfaces. We want to plot the pressure coefficient across the wedge and the new line we created in order to determine the shock angle. In the list of surfaces, select wedge, symmetry, and y = 0.35. Press *Plot*.



We can then use the information from the plot to solve for the shock angle.

$$\theta_{shock} = \tan^{-1}\left(\frac{\Delta y}{\Delta x}\right) = \tan^{-1}\left(\frac{.35-0}{.97-.47}\right) = 34.99^{\circ}$$

The shock angle from the analytical solution was 32.221 degrees. Because we took the value from a graph, a bit more error is to be expected.

#### **Print Drag Coefficient**

Next, we will have FLUENT report the drag coefficient. Close the Solution XY Plot window. In the Outline window, go to **Reports**. In the Reports window under Reports, select Forces and press Set Up.... Ensure Wedge is selected and press Print. The drag coefficient will be printed.

#### Go to Step 7: Verification & Validation

Go to all FLUENT Learning Modules