2. STAR-CCM+ user coding

An airfoil in a free shear layer (a wake, or due to the stratification of the atmosphere).

Design the inlet conditions for this case. Then apply this inlet condition for a computation of an airfoil (you can use your coursework airfoil).



The field function for this profile is implemented as follows:



• Right-click the **Tools > Field Functions** node and select **New**.

A new User Field Function 1 node will appear in the Field Functions tree.

- Servers contraction 🔅 🐨 🗰 🗙 simulation scene/plot 🖕 🛅 🛛 Tools * 🔶 🛅 🛛 Annotations 🛏 🛅 Colormaps - 🛅 🛛 Coordinate Systems Data Set Functions 🔶 🛅 🛛 Field Functions 😥 User Field Function Ctrl-C <u>⊂</u>opy 😥 Absolute Pressure <u>P</u>aste Ctrl-V 😥 Absolute Total Pres: <u>D</u>elete Delete. 😥 Area Rename... 😥 Axial Velocity 😥 Boundary Sliver Cell Indicator
- Right-click the User Field Function 1 node and select Rename...

- Change the name to inflow_bc0 in the Rename dialog and click **OK**.
- In the Properties window, set the **Type** to **Vector**.

Dimensions property. The Dimensions dialog will appear.

	Properties	Ulmensions 🔮	-
	Force	0	f
	Energy	0	
	Power	0	
	Pressure	0	
	Velocity	1	
	AngularVelocity	0	
	Volume	0	
	Moment	0	
	Stress	0	
i mens ions Nysical dimensions			0

- Set Velocity to 1 as shown and click OK.
- In the Properties window, set **Function Name** to inflow_bc0.
- Click the (Custom Editor) button for the Definition property. The Definition editor dialog will appear.
- Enter the following definition:

```
[(($$Centroid("Laboratory")[1] < 0) ? (10+1/12.5*$$Centroid("Laboratory")[1])*
cos(5.0/180.*3.1415927) : (10+1/12.5*$$Centroid("Laboratory")[1])*
cos(5.0/180.*3.1415927)), ((10+1/12.5*$$Centroid("Laboratory")[1])*
sin(5.0/180.*3.1415927)), 0]
```

Note that the function \$\$Centroid("Laboratory ") returns a cartesian vector of the face centroid coordinates in local coordinate system Laboratory; the subscript operator [] is appended to access a single component of the centroid vector (with an index of [0], [1], or [2]).

The Properties window will be as shown below when you are done.

	Properties	inflow_bc0 🎊
🖉 inflow_bc0	Туре	Vector
	Dimensions	Velocity
	Function Name	inflow_bc0
	Definition	[((\$\$Centroid("Laboratory"
	Ignore Boundary Values	
	Assembly code	(vector (if (< \$\${Centroid}(

Setting Boundary Conditions and Values

In this section we will set physical values where necessary,

• Expand the **Regions > Fluid > Boundaries > farfield1 > Physics Conditions** node.



Double click the Velocity node, and setup as below,

	Properties	Velocity 🔆	
😽 Velocity	Coordinate System	Laboratory	
	Method	Field Function	
	Dimensions	Velocity	
Field Function	Vector Function	inflow_bc0	

You should also setup appropriate turbulence intensity and turbulence viscosity ratio for this inlet.

Setup other inlet, e.g. farfield2.