Flow over an Airfoil - Numerical Results

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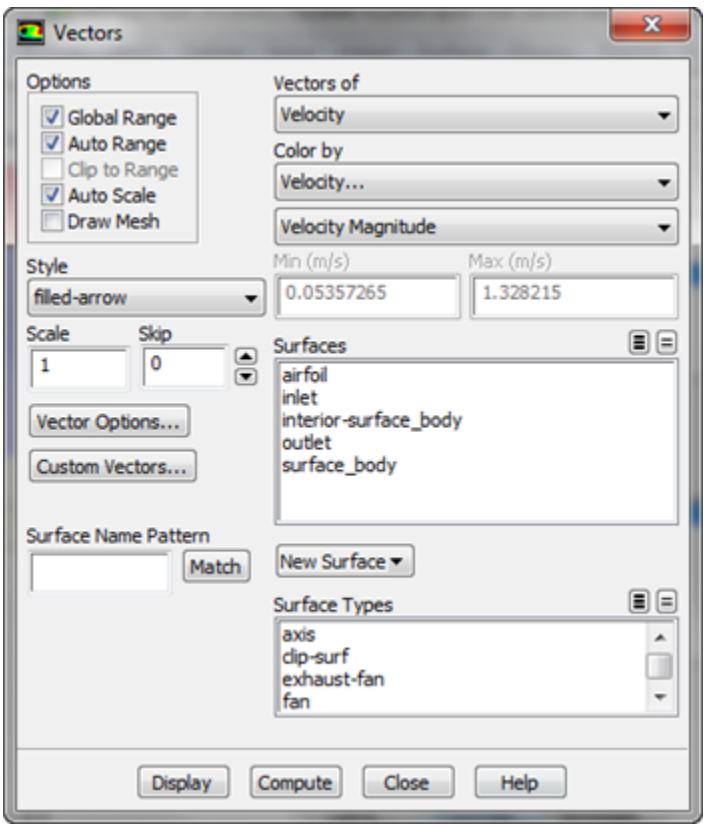
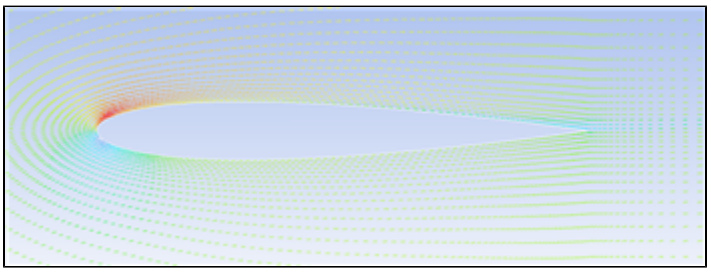
Numerical Results

Velocity

First, we will look at the velocity vectors of the solution to see if they make intuitive sense. To plot the velocity vectors, go to ***Results > Graphics and Animations***. In the *Graphics and Animations* Window, select ***Vectors*** and click ***Set Up...***. This will bring up the *Vectors* Menu.

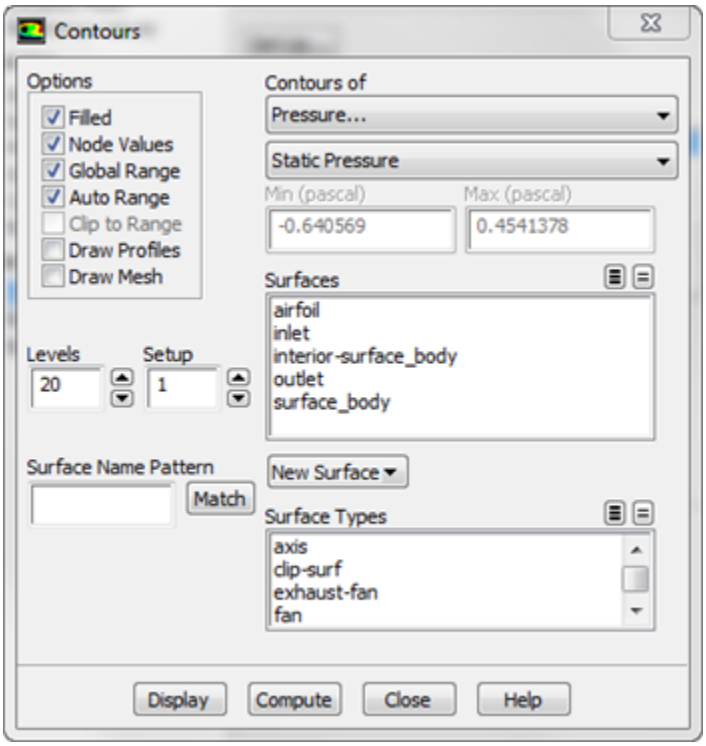


Make sure the settings of the menu match the figure above: namely ***Vectors of > Velocity***, ***Color by > Velocity***, and set the second box as ***Velocity Magnitude***. To see the velocity vectors, press ***Display***.



Pressure Contours

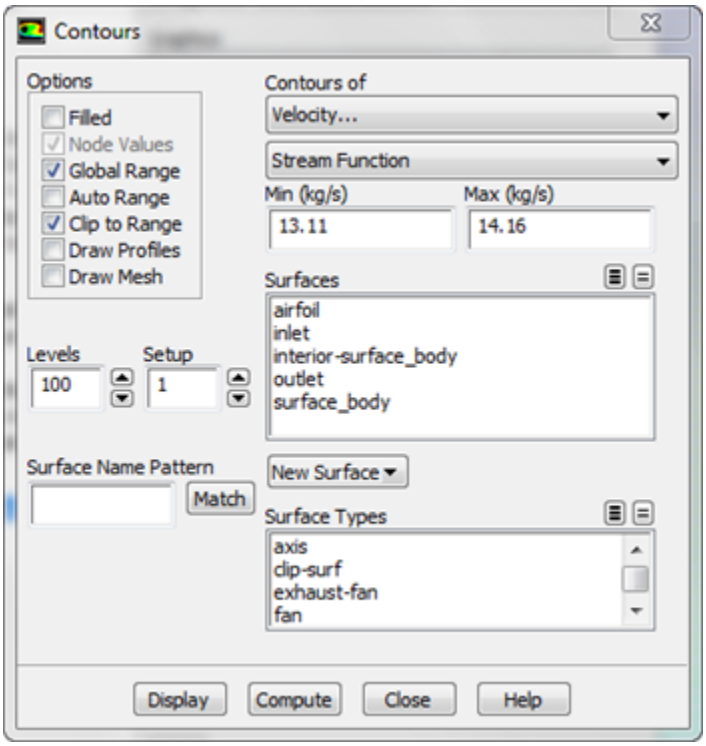
To view the pressure contours over the entire mesh, go to ***Results > Graphics and Animations*** again, and in the *Graphics and Animations* Window, select ***Contours***.
Click ***Set Up...*** to bring up the *Contours* Menu. Check the box next to **Filled**. Under *Contours Of*, ensure that the two boxes that are selected are ***Pressure. ..*** and ***Static Pressure***.



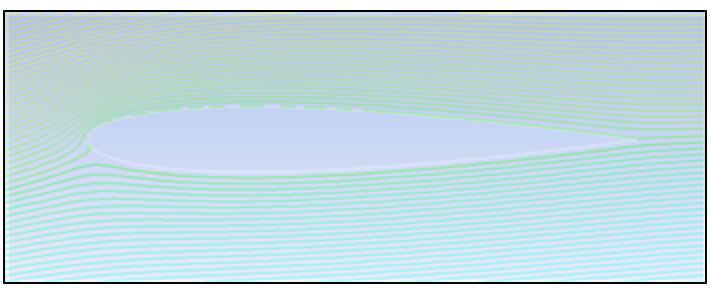
Once these parameters are set, press ***Display*** to see the pressure contours.

Streamlines

To view the streamlines, keep the *Contours* window open, and change the ***Contours Of*** box to ***Velocity***, and the box below to ***Stream Function***. Change ***Levels*** to `100`. Also, uncheck the box marked ***Auto Range***, and set ***Min(kg/s)*** to `13.11`, and ***Max(kg/s)*** to `14.16`

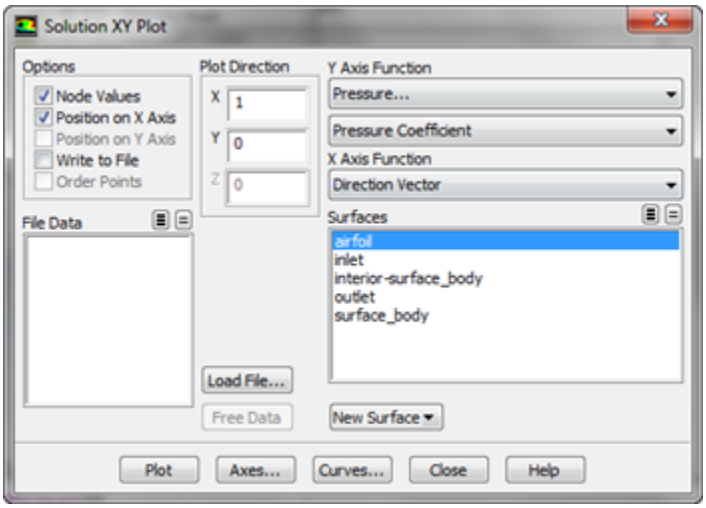


To view the streamlines, press ***Display***



Pressure Coefficient

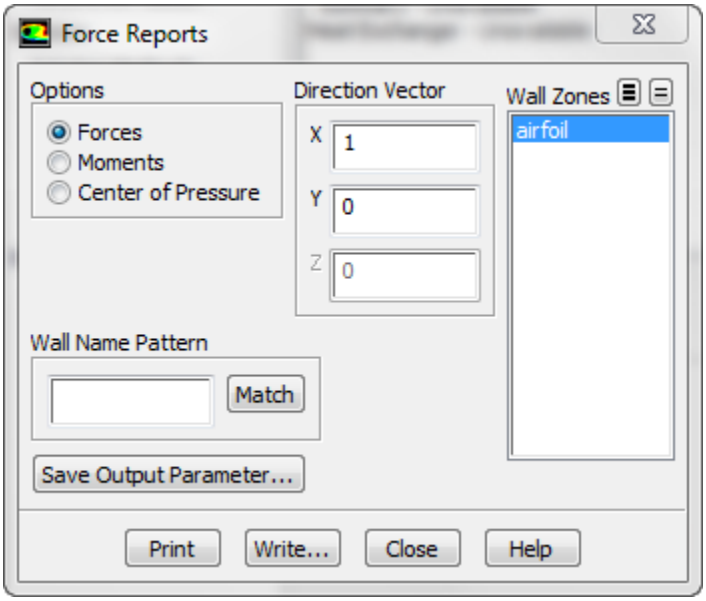
Next, we will plot the pressure coefficient along the surface of the airfoil. Click on ***Results > Plots*** to open up the *Plots* Window. Under **Plots**, select ***XY Plot***, and click ***Set Up...***. In the window that pops up, change the settings ***Y-Axis Function > Pressure***, and change the second box to ***Pressure Coefficient***. Ensure ***X-Axis Function > Direction Vector***. Under **Surfaces**, select ***airfoil***. See the figure below for help.



When all the settings are correct, press ***Plot*** to plot the data to the command window. To save the data to a text file, check the box next to ***Write to File***. You'll notice that the ***Plot*** button has been replaced by a button marked ***Write...***, click it. Change the file type to ***All Files*** and save the file name as `Pressure_Coefficient.txt`

Coefficients of Lift and Drag

To find the Coefficients of Lift and Drag, click ***Results > Reports*** to bring up the *Reports* Window. In the *Reports* Window, select ***Forces*** and click ***Set Up...*** . This will bring up the *Force Reports* menu



We need to set the parameters so drag across the airfoil (keep in mind, which is at an angle) will be displayed. In the *Force Reports* window change the *Direction Vector* such that ***X > .9945*** and ***Y > .1045***. Click ***Print*** to print the drag coefficient to the command window. To print the lift coefficient, in the *Force Reports* window change the *Direction Vector* such that ***X > -.1045*** and ***Y > .9945***. Again, press ***Print***.

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