

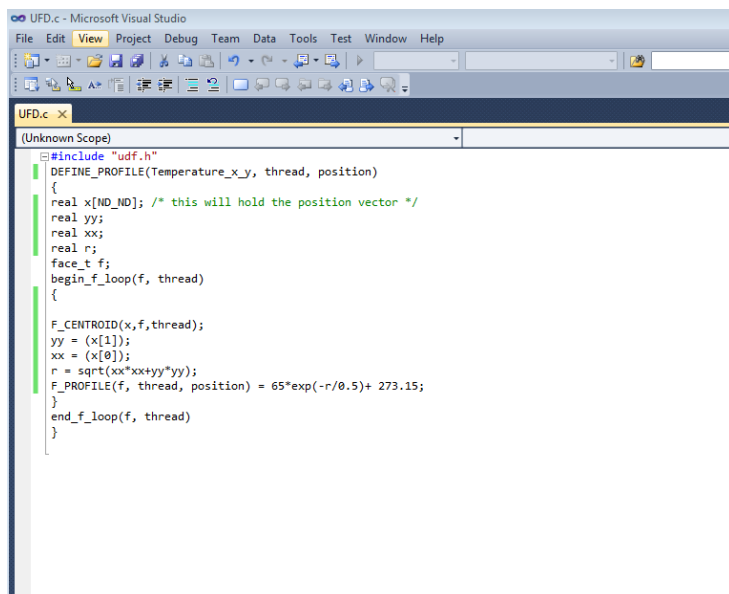
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MAE 598
10/13/2016

No collaboration

Challenge 1:

UDF code:

```
#include "udf.h"
DEFINE_PROFILE(Temperature_x_y, thread, position)
{
    real x[ND_ND]; /* position vector */
    real yy;
    real xx;
    real r;
    face_t f;
    begin_f_loop(f, thread)
    {
        F_CENTROID(x,f,thread);
        yy = (x[1]);
        xx = (x[0]);
        r = sqrt(xx*xx+yy*yy);
        F_PROFILE(f, thread, position) = 65*exp(-r/0.5)+ 273.15;
    }
    end_f_loop(f, thread)
}
```



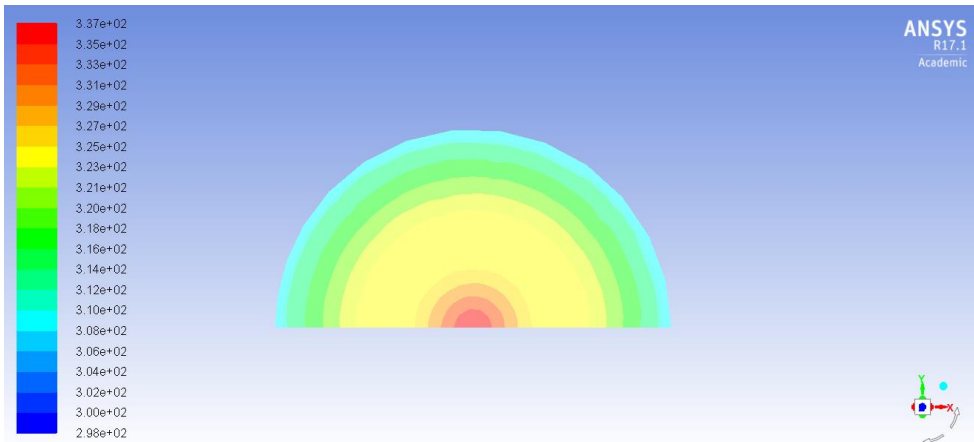
The image shows a screenshot of the Microsoft Visual Studio IDE. The main window displays the source code for a User-Defined Function (UDF) named 'Temperature_x_y'. The code is written in C and includes the following elements:

- `#include "udf.h"`
- `DEFINE_PROFILE(Temperature_x_y, thread, position)`
- A block of code enclosed in curly braces that defines the function's logic:

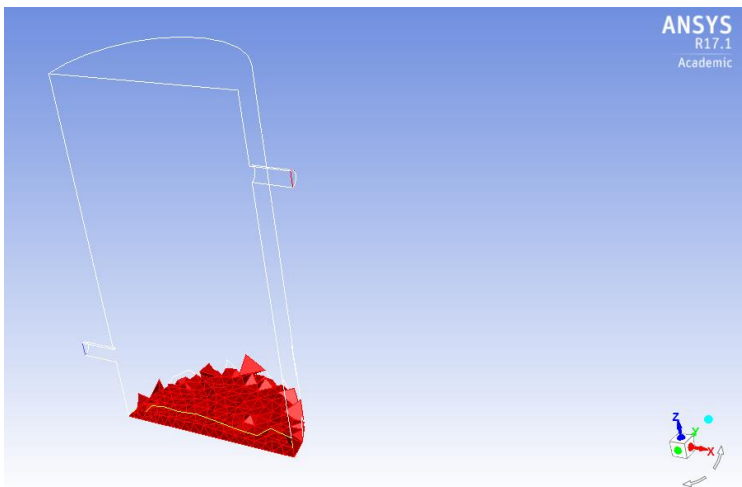
```
{
    real x[ND_ND]; /* this will hold the position vector */
    real yy;
    real xx;
    real r;
    face_t f;
    begin_f_loop(f, thread)
    {
        F_CENTROID(x,f,thread);
        yy = (x[1]);
        xx = (x[0]);
        r = sqrt(xx*xx+yy*yy);
        F_PROFILE(f, thread, position) = 65*exp(-r/0.5)+ 273.15;
    }
    end_f_loop(f, thread)
}
```

The Visual Studio interface includes a menu bar (File, Edit, View, Project, Debug, Team, Data, Tools, Test, Window, Help), a toolbar with various icons, and a Solution Explorer on the left side showing the file 'UDF.c'.

Contour plot at the bottom of the tank:



Mesh Refinement:



1. Outlet Temperature

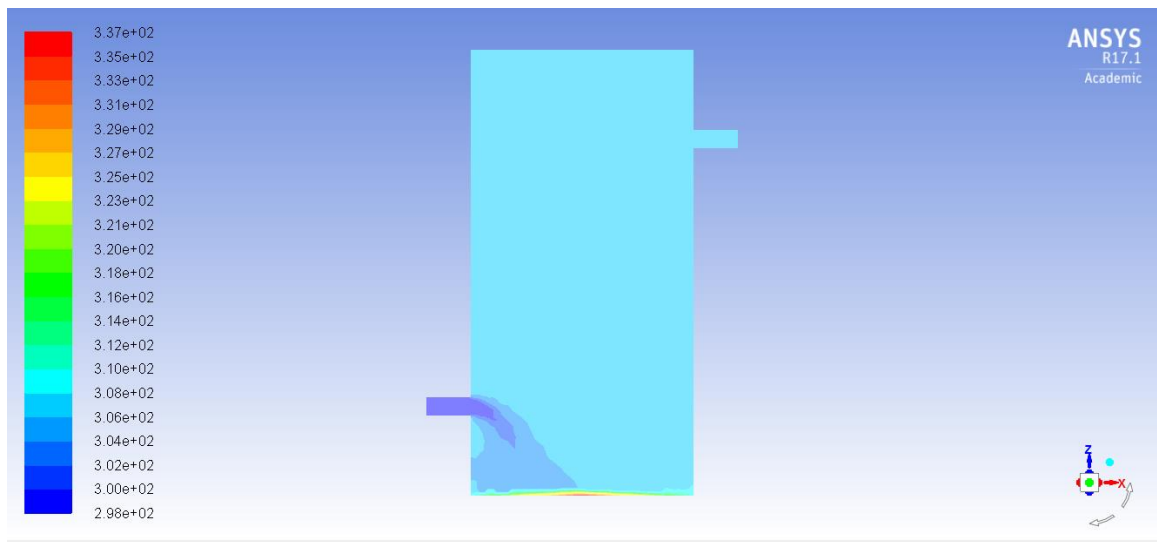
$$T_{out} = \frac{\int \int v_n T dA}{\int \int v_n dA}$$

Integral numerator	
pressure_outlet	0.0094146682
Integral X Velocity (m/s) (m2)	
pressure_outlet	3.090456e-05

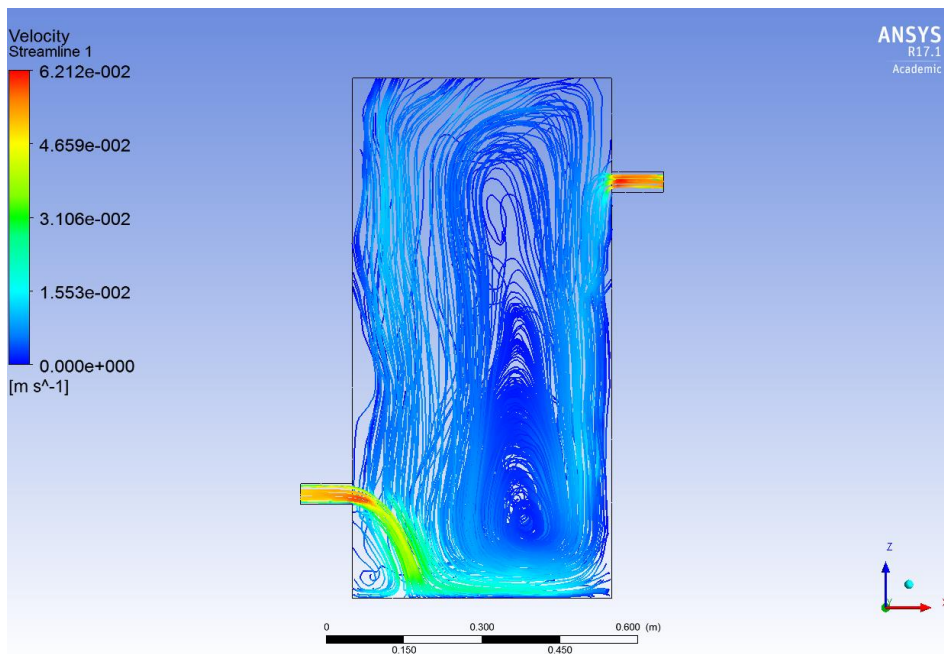
$$T_{out} = \frac{0.0094146682}{3.090456e-05} = 305.1967 K$$

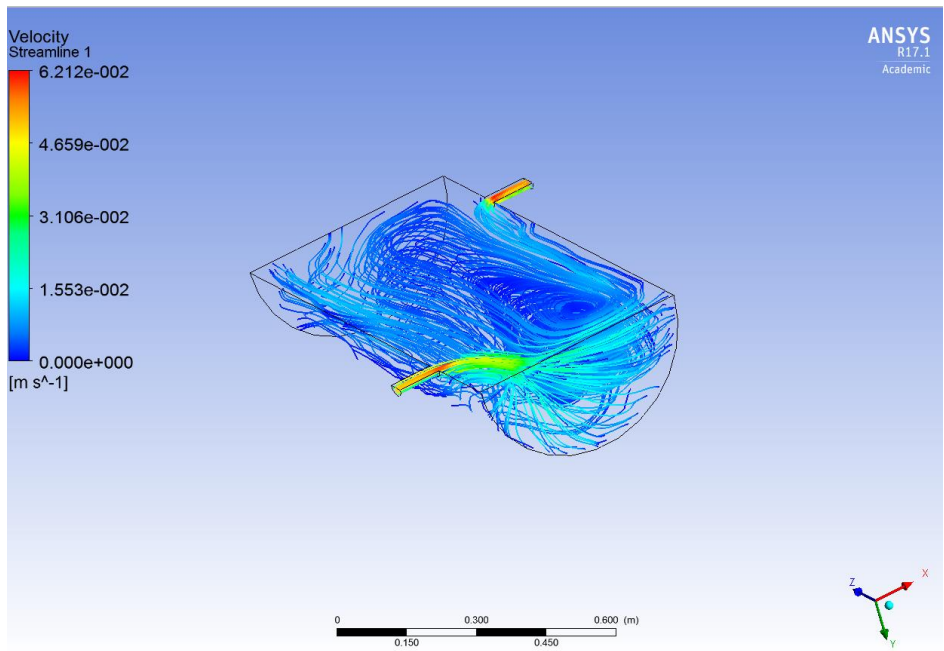
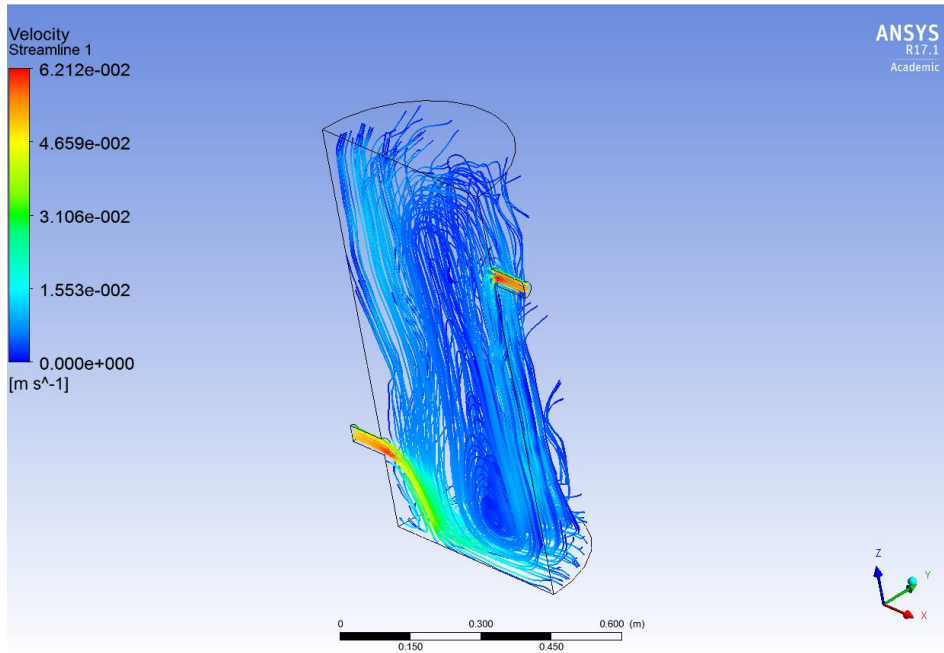
Mass-Weighted Average Static Temperature (k)	
pressure_outlet	305.1967

2. Contour plot



3. Streamlines





References:

http://www.public.asu.edu/~hhuang38/apache/acfd_c2_answer1.pdf

http://imechanica.org/files/fluent_13.0_lecture08-udf.pdf

<http://www.engr.uconn.edu/~barbertj/CFD%20Training/Fluent/7%20User%20Defined%20Functions.pdf>