Final Project CHE 348

Lan Do

My final project was to create a function that could calculate the steady state heat profiles of cartesian, cylindrical, and spherical geometries. The motivation behind this project was not only its relevance in chemical engineering, but I also wanted to develop a project with multiple parts where the user has multiple functionalities in one program.

I used an iterative method to calculate the heat profiles. Analytical methods are possible to calculate heat profiles but can be incredibly cumbersome when large amounts of resistances are applied. This is also in the spirit of numerical methods – using iterative solving methods when analytical methods are too complicated or tedious to do. The formulas to iterate by are listed as follows:

Where:

Q = Heat Flux

T = Temperature at each resistance

R = Resistance value through each resistance

For Cartesian Geometry:

Where:  
x = x coordinate or radius

k = thermal conductivity

For Cylindrical Geometry:

Where:

ALM = Log mean area

r = Radius

For Spherical Geometry

Where:

AGM = Geometric mean area

To calculate the heat profiles with increasing accuracy, the terms are brought close to zero and the points are put on a plot. One can also compare the final temperature calculated with the values derived from the iterative calculations to determine the accuracy of calculations.

**Some important notes:**

The cartesian heat flux values are in power/length^2, the cylindrical heat flux values are in power/length, and the spherical heat flux values are in power. This greatly changes the q values calculated in the script but was done for the simplicity of calculations later in the scripts.

xStep must evenly divide into each resistance length. This is so that resistances calculations do not end in between resistances.

Some next steps would be to calculate the profiles for mass and momentum transfer. The setup probably would not be very difficult, as most of the equations are the same.

Example behavior is given in test\_heatprofile.mlx. Please view this, as the formatting is way better than what word can provide.

For a much easier way to view all my code, I have compiled my code onto a Github repository. You can see it here (.