**Revised: Monte-Carlo Modeling of Electron Transport**

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Assignment 1

ELEC 4700 A

A2 11:30-1:30pm

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## Electron Modeling

1. In “Assignment1\_Part1\_JulieAnneChaine.m” file, I calculated a Vth of 1.86985 m/s
2. In the same file I calculated a MFP of 3.7395e-8 m
3. Chart, line chart

   Description automatically generated

Figure 1.1: 2D Particle Trajectory Sample

1. Chart

   Description automatically generated with low confidence

Figure 1.2: Temperature Plot without Collision for 10 Samples in Time

We know the temperature should be constant since we aren’t losing any energy when the particles collide with the upper and lower boundaries.

## 2.0 Collisions with Mean Free Path

Chart, histogram

Description automatically generateda) From the “Assignment1\_Part2\_JulieAnneChaine.m” file:

Figure 2.1: Velocity Distribution Histogram

I’ll acknowledge that this histogram is incorrect. I couldn’t seem to figure out how to scale the equations correctly so that Vth is the velocity mean.

Chart, line chart

Description automatically generatedb)

Figure 2.2: 2D Particle Trajectory Sample with Collision

Chart, scatter chart

Description automatically generatedc)

Figure 2.3: Temperature Plot with Collision for 10 Samples in Time

We can see that the temperature is no longer constant since there is energy transfer when the particles collide. To get a better understanding of the overall effect on the temperature over time I’d have to plot for more points.

d) From my code in “Assignment1\_Part2\_JulieAnneChaine.m” the mean free path was calculated to be 2.7588e-8 m/s and the time between collisions is around 0.16542 ps.

## 3.0 Enhancements

Chart

Description automatically generateda) From the “Assignment1\_Part3\_JulieAnneChaine.m” file:

Figure 3.1: 2D Particle Trajectory Sample with Collision and Boxes

As can be seen in the figure above, the code isn’t perfect, and the particles will pass the box boundaries by a little distance before being reflected. It is worse the faster the velocity is as there is more movement for the same time step.

Chart, bar chart

Description automatically generated

b)

Figure 3.2: Electron Density Map

Chart

Description automatically generatedc)

Figure 3.3: Temperature Map

Note: my units are a little bit off. The temperature magnitude is a little warmish. Toasty at best.

Chart, line chart

Description automatically generated

Figure 3.4: 2D Particle Trajectory Sample with Collision, Boxes, and a Circle

I have unfortunately been unable to implement the circle boundary conditions so the particles can still go through it. Above is a figure with the circle but with particles still travelling through.