PHY407: Lab 8

Date: November 5th. 2021

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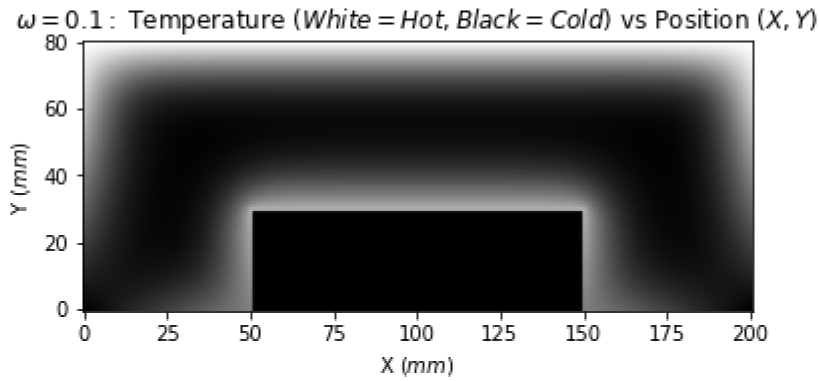
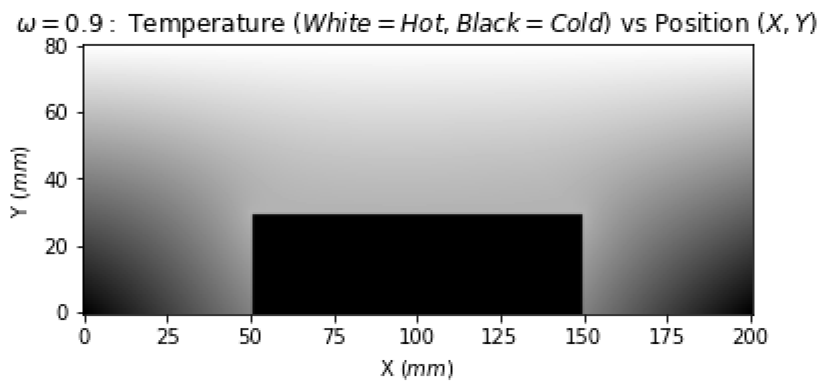
Contributions:

- Q1. Nikolaos Rizos
- Q2. Brendan Halliday
- Q3. Nikolaos

Q1.b.

Below are the two plots for the final solution for omega = 0.1 and omega = 0.9

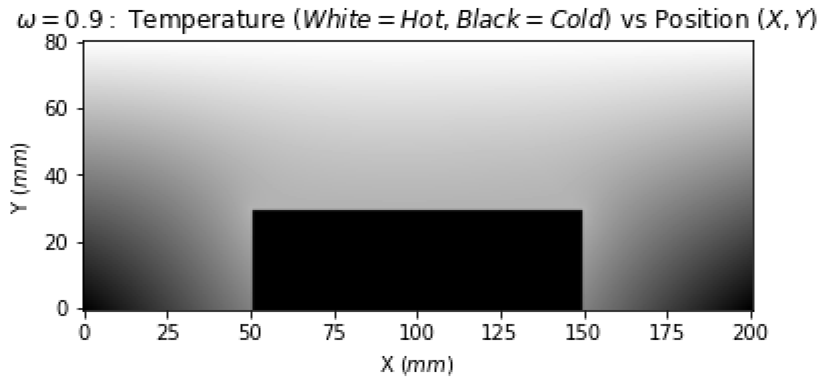




As can be seen, the solution for omega=0.9 has a more even temperature distribution than omega = 0.1. This makes physical sense since heat should distribute evenly. This means that the over relaxation method for increased omega speeds up the calculation for the solution of the distribution.

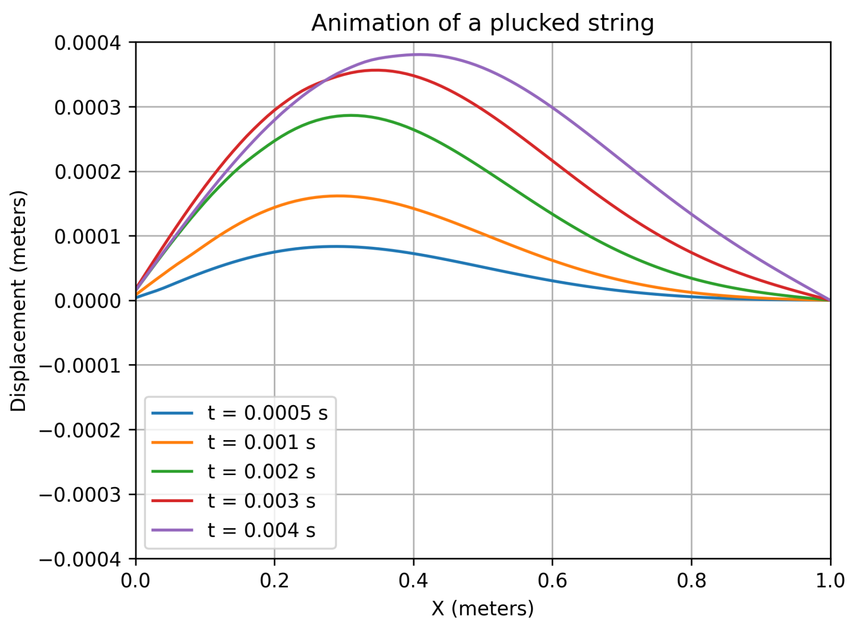
Q1.c.

We notice that in the early, non converged stages of the solution, the profile is not symmetric about the vertical bisector. However, as it finally converges, it does become symmetric. Below is a plot of the converged solution. As the solution finally converges, the calculated temperature at x = 2.5 cm, y = 1 cm is 3.26 degrees celsius.

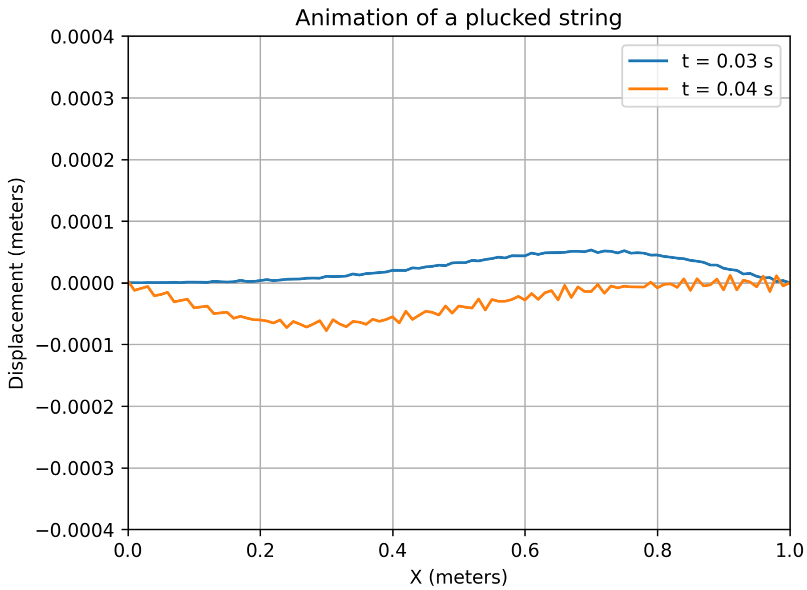


Q2.

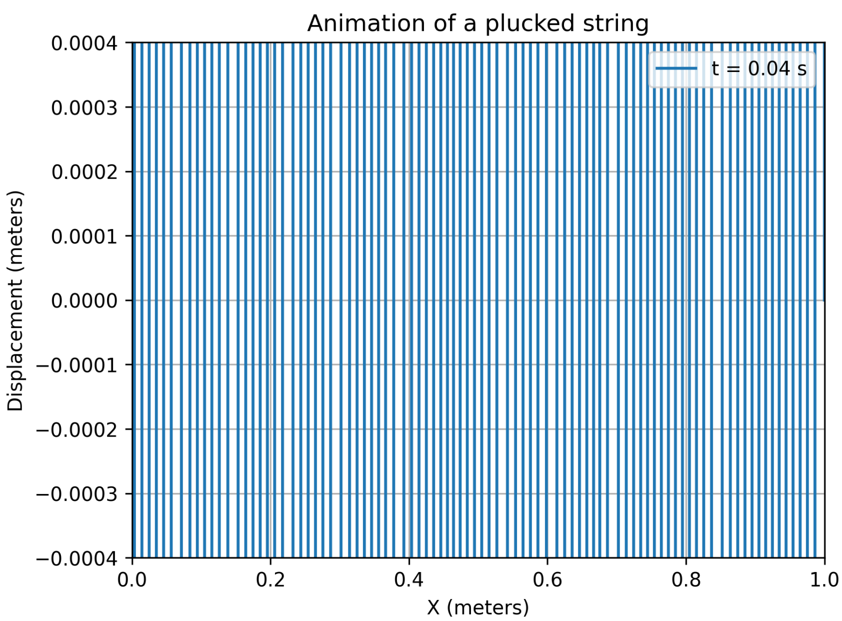
Here are some plots before the solution goes unstable.



After sometime, the solution turns into this:



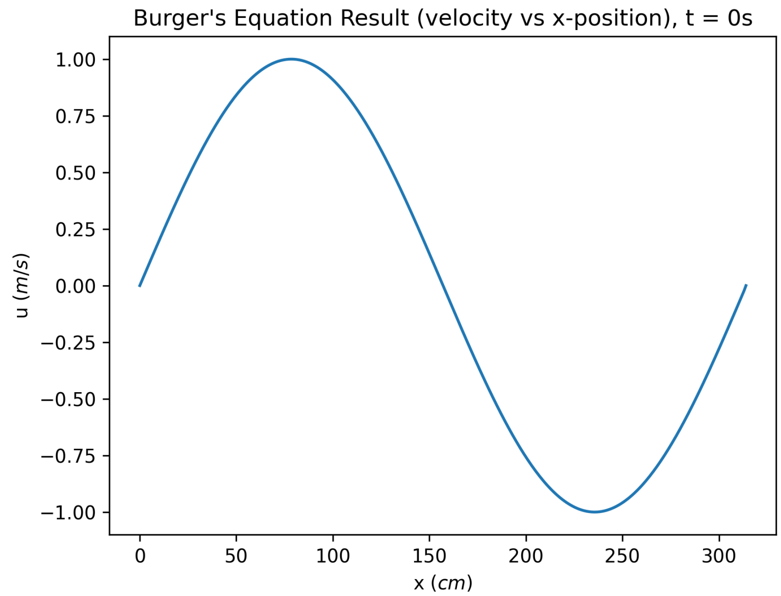
The form of the wave is still somewhat visible, but perhaps less so. After even more time, the solution becomes super unstable.

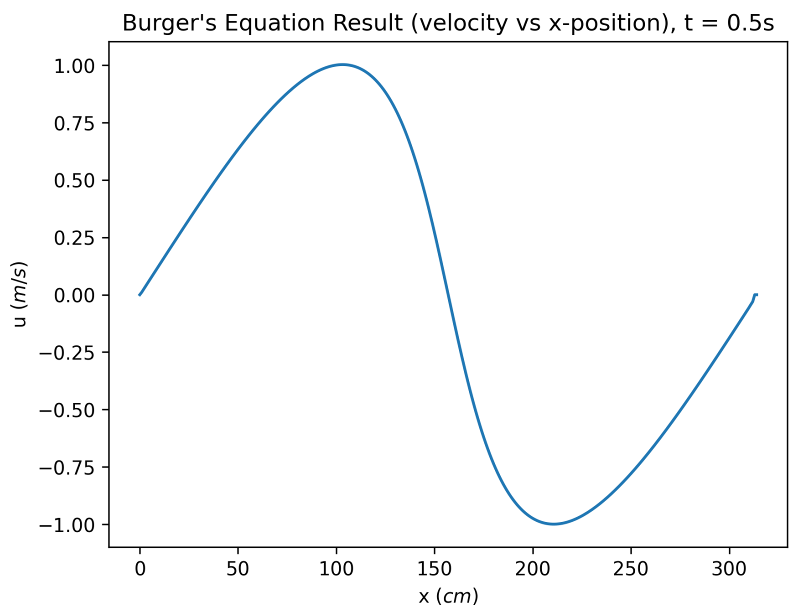


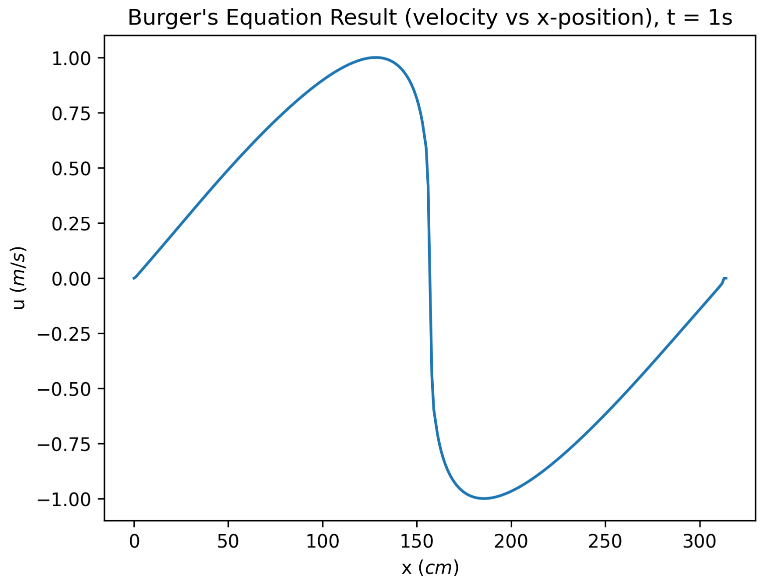
Which is clearly incomprehensible and unstable.

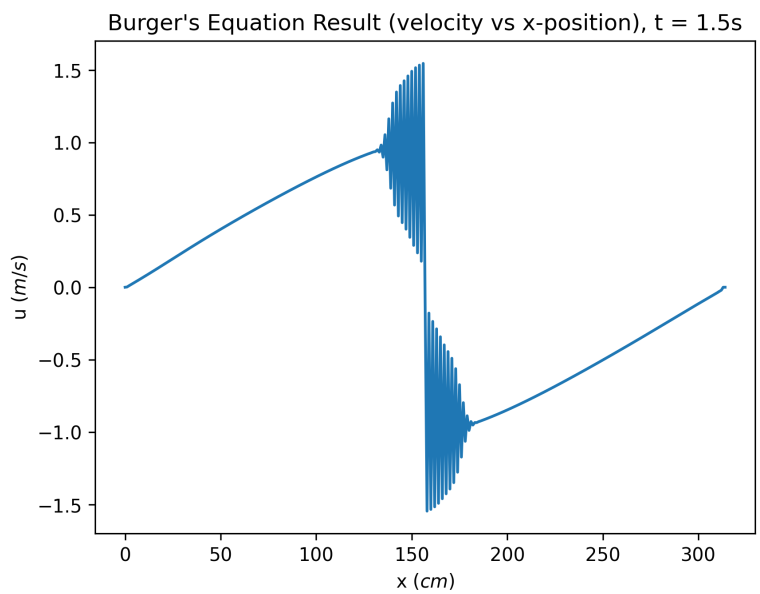
Q3.

Here are the plots generated for increasing time:


Burger's Equation Result (velocity vs x-position), t = 0s
u (m/s)
x (cm)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
50
100
150
200
250
300


Burger's Equation Result (velocity vs x-position), t = 0.5s
u (m/s)
x (cm)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
50
100
150
200
250
300





We see as time progresses, the results for Burger's equation approaches something like a sawtooth function. However, for time 1.5s, we see dramatic and unrealistic aberrations near the "discontinuities".