PHY407H1 Lab9

Eric Yeung*

Department of Physical Sciences, University of Toronto, Toronto M1C 1A4, Canada

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QUESTION 1

a) See Assignment 9_Analysis.pdf by me.
b) See Lab9_q1b.py by me.

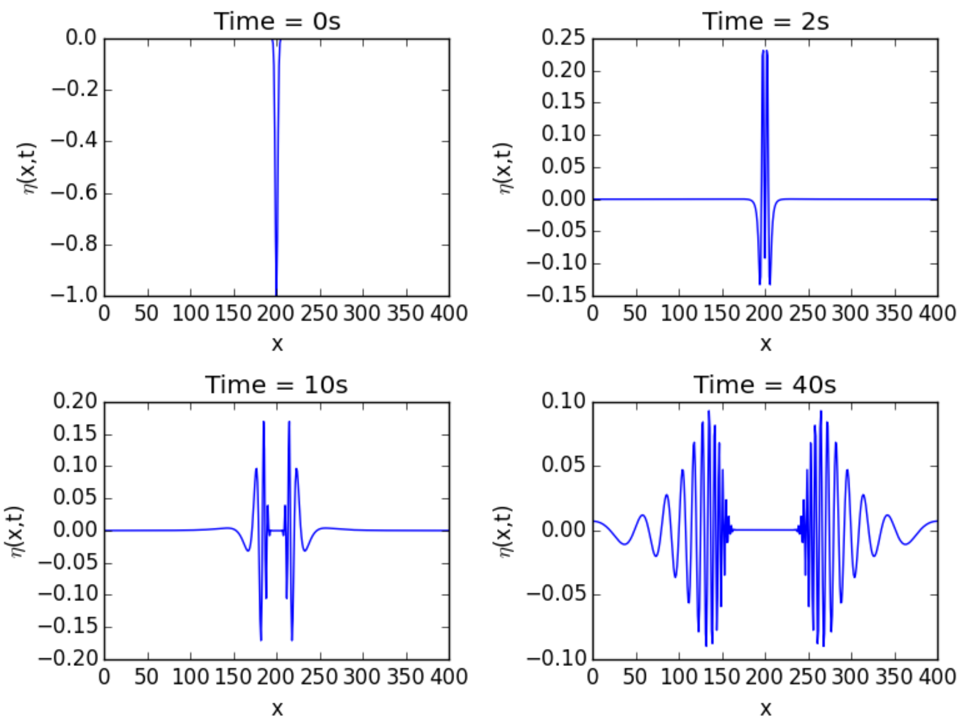


FIG. 1: Plot for η(x,t)

* eric.yeung@mail.utoronto.ca

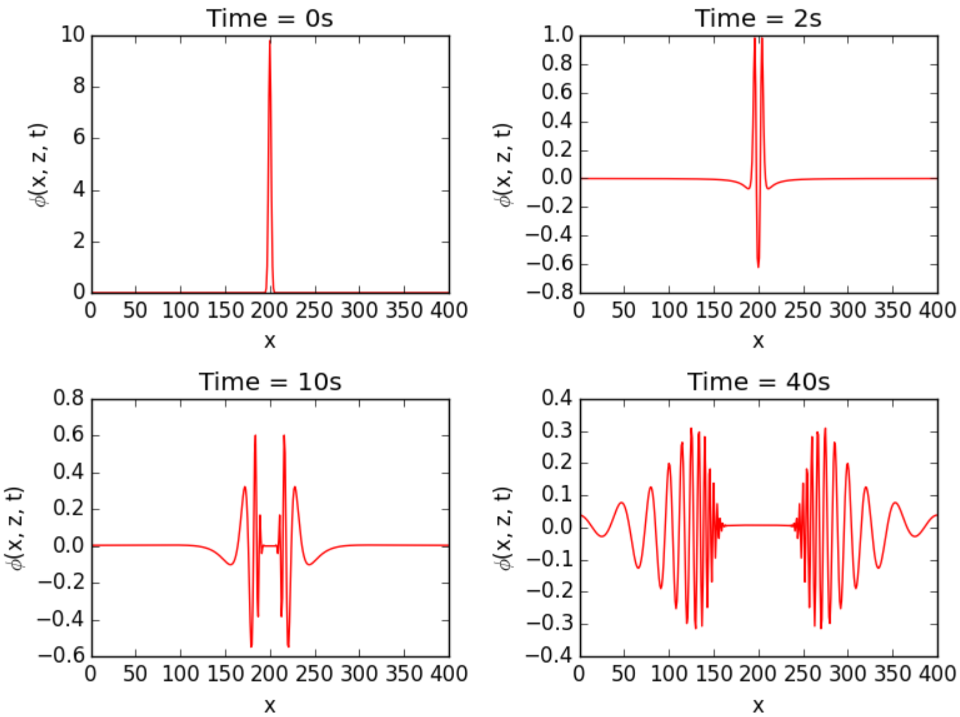


FIG. 2: Plot for ϕ(x,z,t)

The spectral method gives me around the same answers for η(x,t). Regarding speed, this simulation (spectral method) took 0.698999881744 seconds!

The ϕ(x, z, t) looks like η reflected along the x axis. The solutions that Paul gave out showed the contour plots of ϕ. My code accounted only for ϕ when z = 0. I didn't have time to troubleshoot/debug the phi solution, but the solution at $\phi(z = 0)$ seem to be what I would expect.

In comparison with the graphs I got in Lab8, shown below:

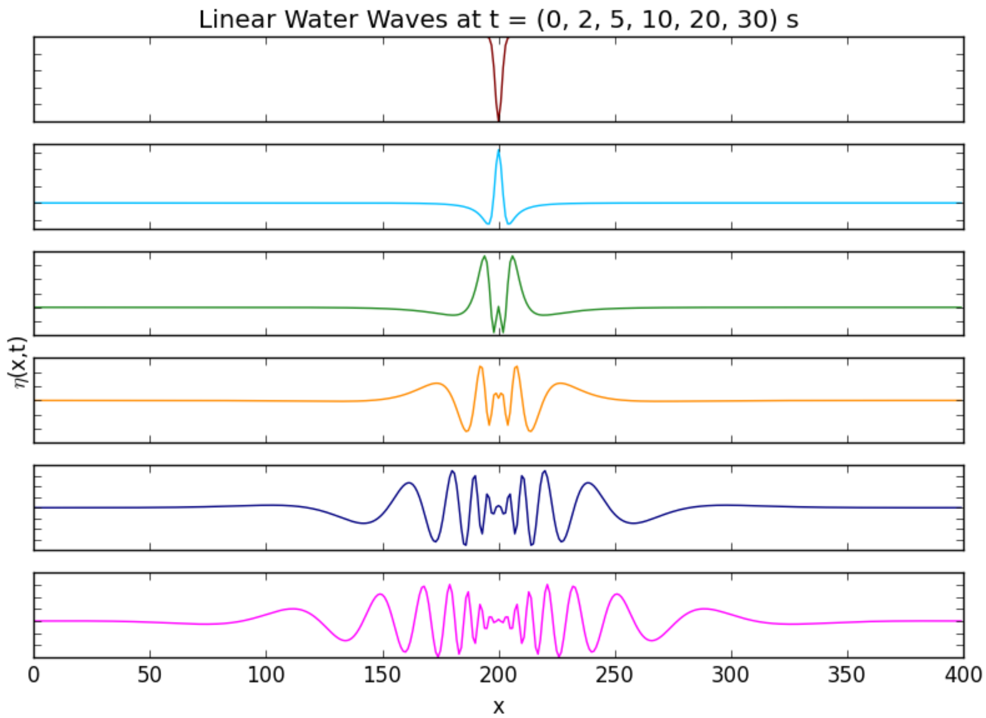


FIG. 3: The figure from the last lab

QUESTION 2

a) b) c)See Lab9_q2abc.py by Chi.

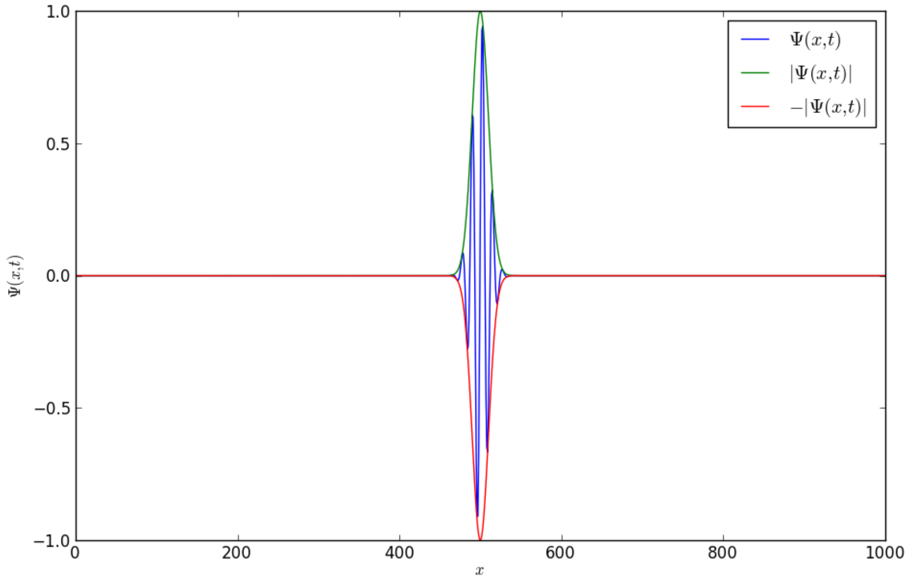


FIG. 4: Wave function from Crank-Nicolson Method

The animation is shown in a vpython window. The time dependent wave function is simply evolving in time from starting in a stationary state. We can see the solution is oscillating between two points (the ends of the potential wall).

d)See Lab9_q2d.py by Chi.

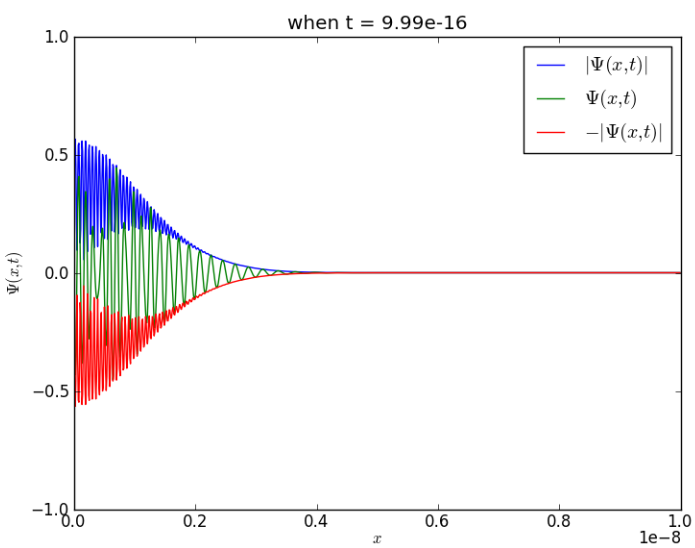


FIG. 5: x0 = 0.4L

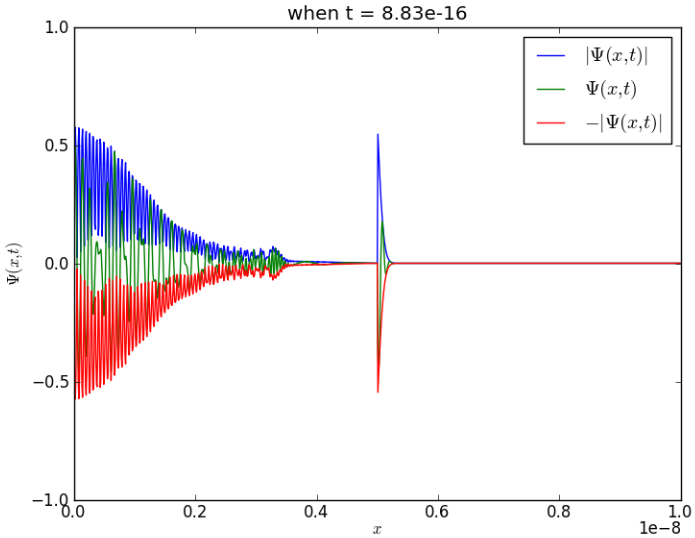
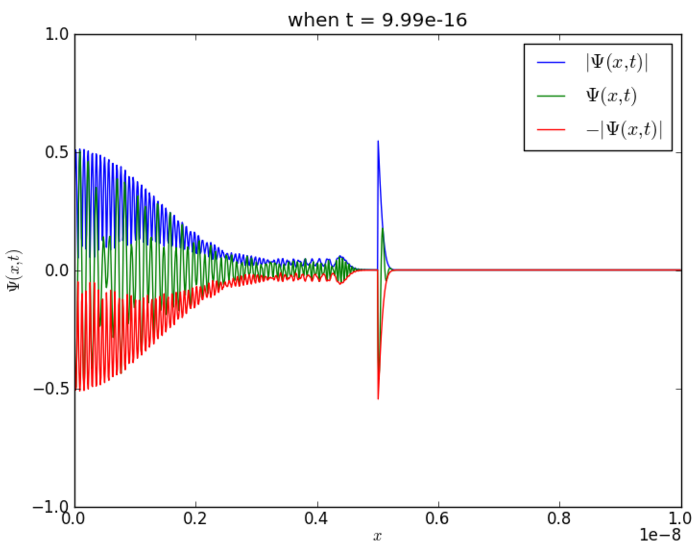


FIG. 6: x0 = 0.49L



With the potential jump, I can see that wave function spikes at around L/2, which is where our potential jump is.