Notes and Results for Chapter 7

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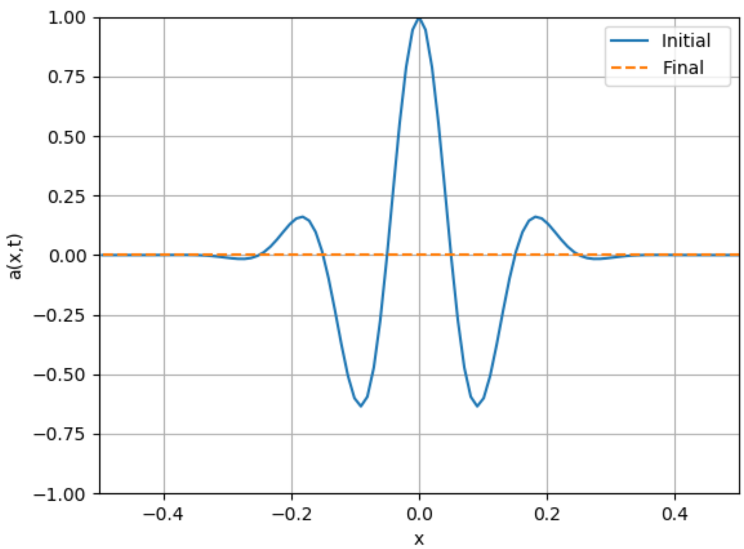
1 Problem A

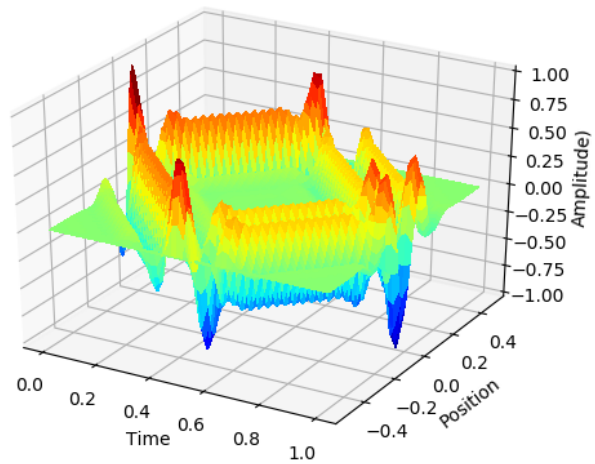
When the wave hits the boundary it goes to zero, which is what is expected (see figure below). This is expected because we are solving the advection equation; the advection equation only allows rightward moving solutions, so when it hits the boundary it makes sense that it must die out.



2 Problem B

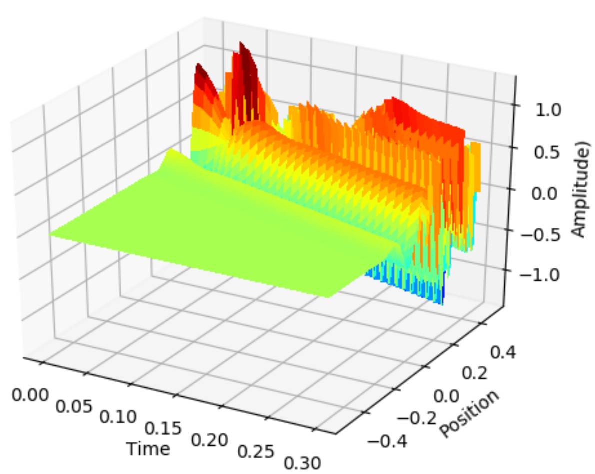
a)

See below for the output image of the wave equation solution for $\tau = 0.01$ s, 101 grid points, and 100 total steps.



b)

To create a solution where the wave moves only to the right initially I shifted the initial condition $A(x,0)$ by a small amount (0.4). Notice that as the wave begins to propagate it only moves in the $+x$ direction:



3 Problem C

For the damped wave I adjusted the method for solving to

$$A_i^{n+1} = \frac{(2+\tau)A_i^n - A_i^{n-1} + \frac{c^2\tau^2}{h^2}\left(A_{i+1}^n - 2A_i^n + A_{i-1}^n\right)}{1+\tau}$$

ignoring α in the equation since for this case it equals 1. Below you can see that when allowed to run for ten seconds, the wave indeed goes to zero, which shows that the solver is working as expected since we are modeling a damped wave.