

Introduction

This lab's purpose was to introduce writing and calling functions in MATLAB, as well as plotting graphs. This included creating unit step, ramp, and pulse functions.

Exercises

- Unit Step Function

- For plotting the unit step function, the first line of code sets the bounds of t $[-5,5]$ and the size of each increment over the interval where a value of $u(t)$ is taken. The second line plots $u(t,0)$ over the given interval of t .
- When the step size is increased to 0.1, the slope of $u(t)$ decreases at turn on time, $t=0$. In other words, it takes longer for the transition from 0 to 1 to occur.
- The $u(t,t_0)$ function is telling MATLAB to set the output, y , to the result of the logical operation $t \geq t_0$. That is, when the operation is FALSE, $y = 0$, and when the operation is TRUE, $y = 1$. Therefore, when $t < t_0$, the step function output is 0, and when $t \geq t_0$, the step function output is 1.

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MATLAB Drive > ELEC 2120 > Lab 5
Editor - /Users/samuelservick/MATLAB-Drive/ELEC 2120/Lab 5/u.m
u.m x r.m x Plotting.m x pulse.m x Sections.m x SpecifyLegendLocati
1 function y = u(t,to)
2 %u Unit Step Function
3 %y = u(t,to) implements the unit step function, u(t-to).
4 %u(t) is 0 for t<to and 1 for t>= to, t>=to is logical expression so either
5 %1 or 0
6
7 y = t>=to;
8 end

```

- Ramp Function

- The statement $y = (t-t_0).*(t \geq t_0)$ is setting the output, y , of the ramp function equal to the element-wise multiplication of $t-t_0$ and the logical statement $t \geq t_0$. This means $y = 0$ for any $t < t_0$ since the product will be 0 ($t \geq t_0$ is false and evaluates to 0), and $y = t-t_0$ for any $t \geq t_0$ ($t \geq t_0$ is true and evaluates to 1).

```

MATLAB Drive > ELEC 2120 > Lab 5
Editor - /Users/samuelservick/MATLAB-Drive/ELEC 2120/Lab 5/r.m
u.m x r.m x Plotting.m x pulse.m x Sections.m x Specify
1 function y = r(t,to)
2 % Unit Ramp Function
3 %y = r(t,to) implements the unit ramp function r(t - to)
4 %returns unit ramp function r = (t,to)
5 y = (t - to) .* (t>=to);
6 end

```

- plot of $r(t, t_0)$ where $t_0 = 0$.

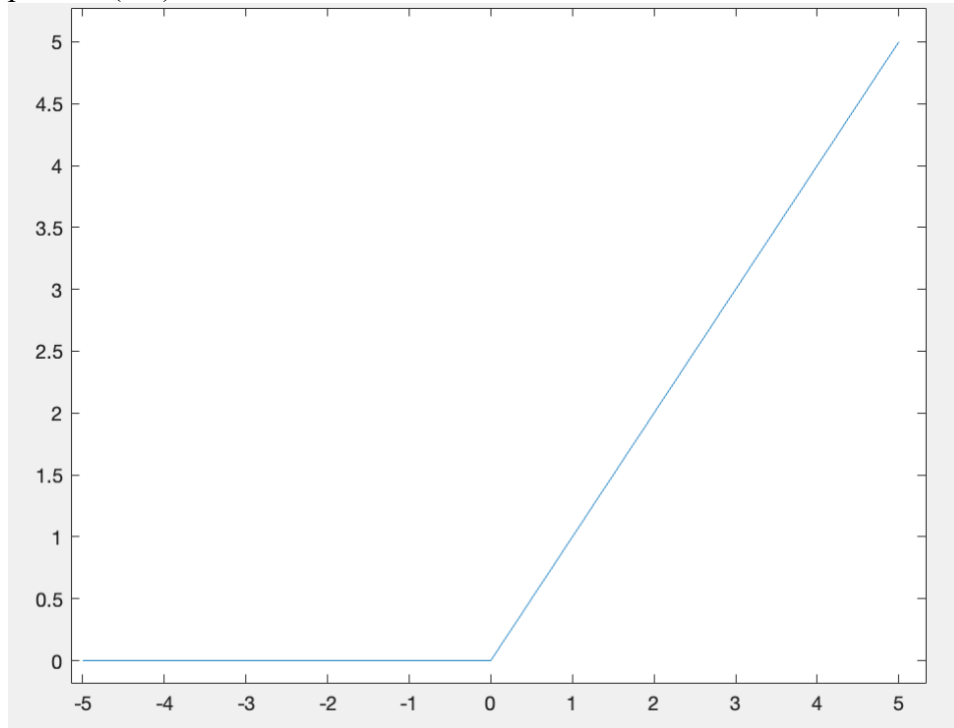


Figure 1. Plot of Ramp Function with no time shift

- plot of $r(t, t_0)$ where $t_0 = 2$

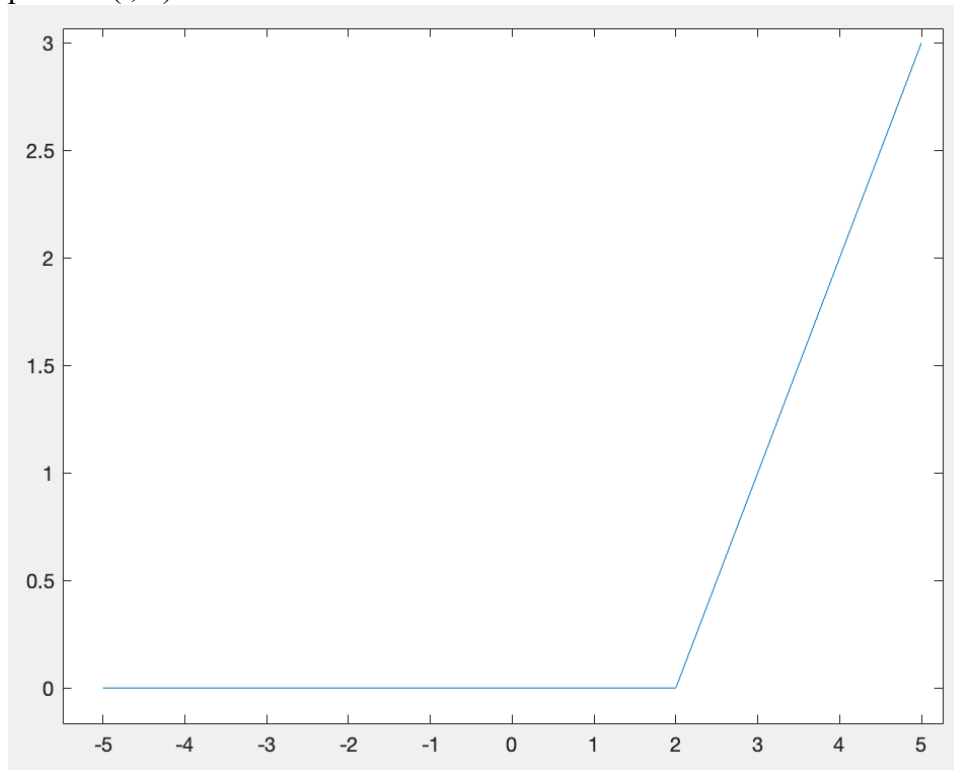


Figure 2. Plot of Ramp Function delayed by $t_0 = 2$

- Plotting Skills
 - o Recreation of $u(t)$ and $r(t)$ subplot

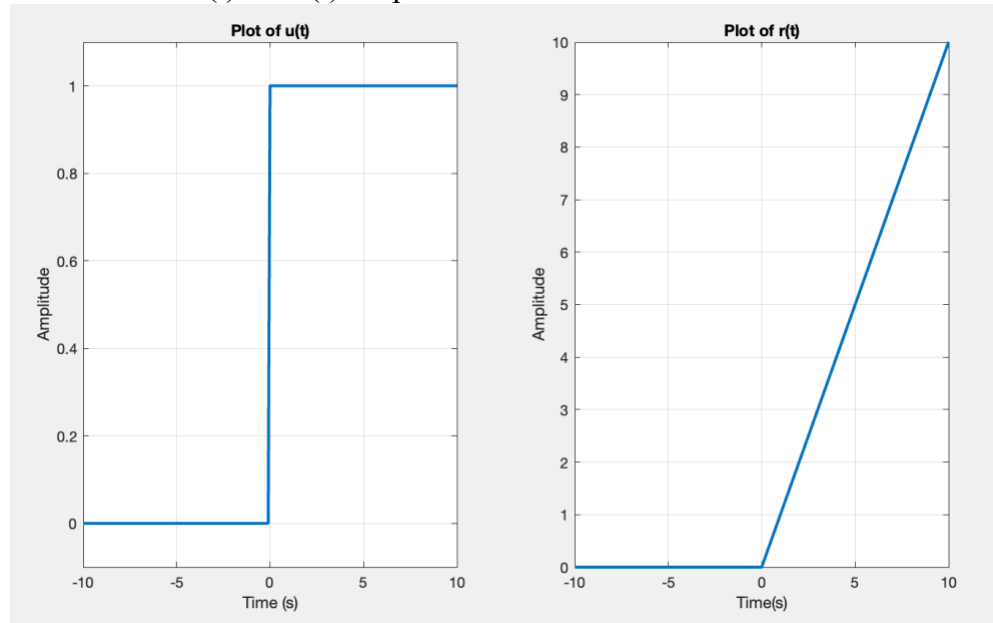


Figure 3. Recreation of plot of $u(t)$ and $r(t)$

- Pulse Function

- o

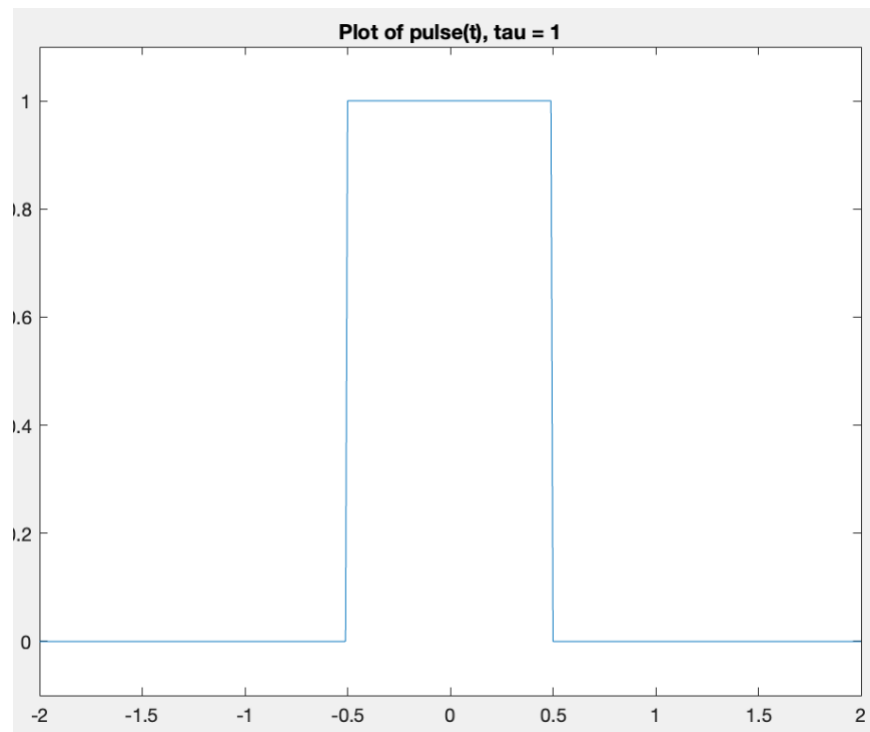


Figure 4. Pulse Function with width of 1

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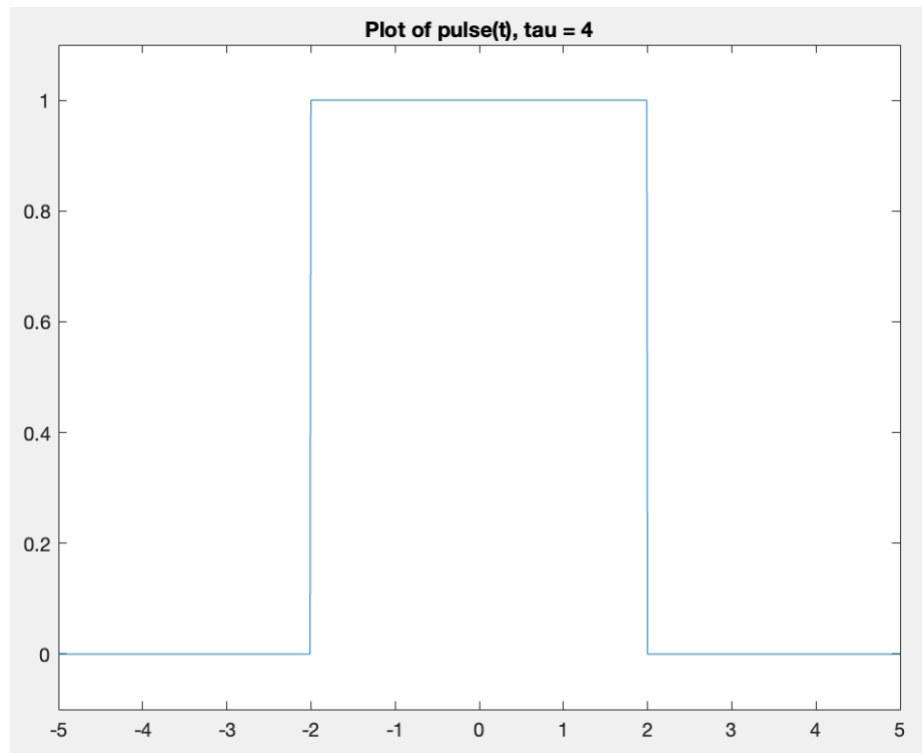


Figure 5. Pulse Function with width of 4

- Sections

- Subplot plots multiple functions separately on a single figure versus plotting functions on separate figures. This aligns the graphs nicely and makes data more presentable.

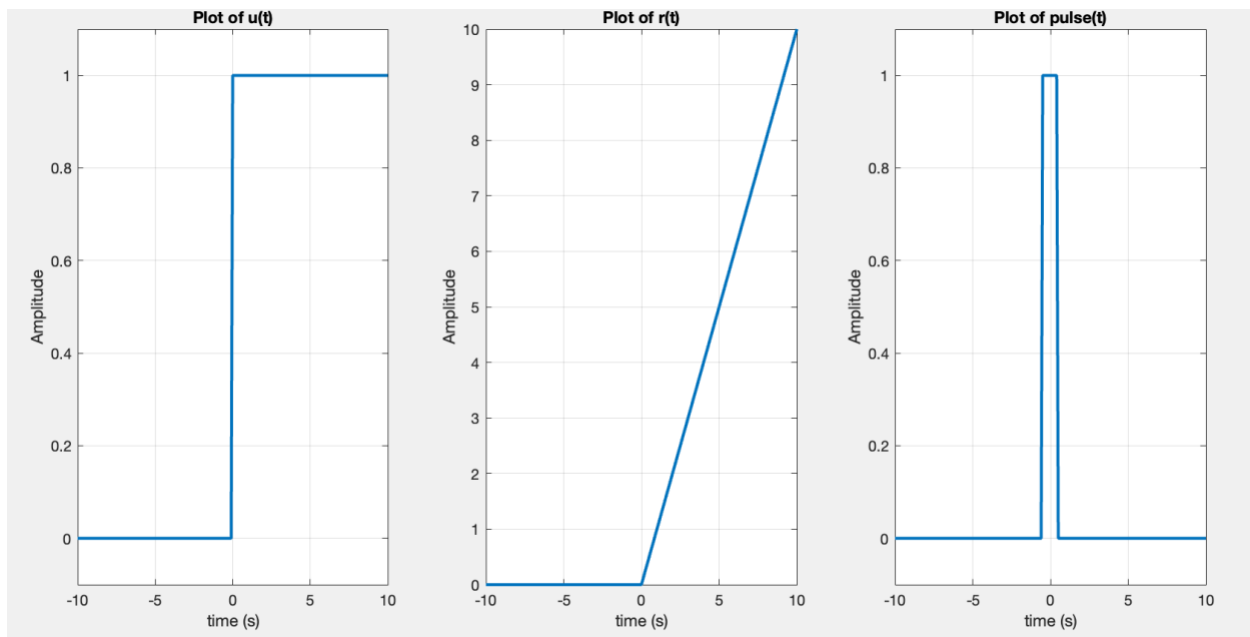


Figure 6. Recreation of Figure 4 in lab manual

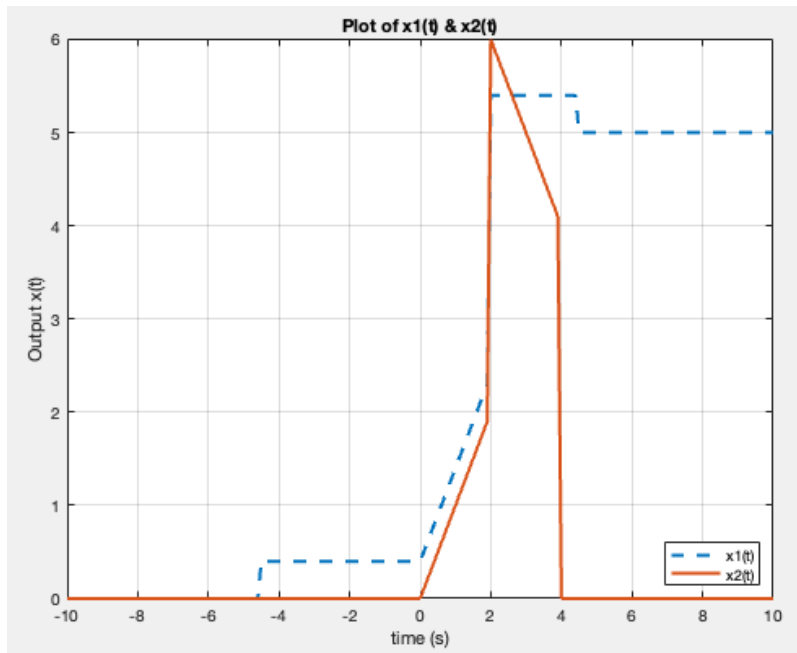


Figure 7. Plot of Functions $x_1(t)$ and $x_2(t)$ from lab manual

Conclusion

It was enjoyable learning how to create functions in MATLAB. This is a very useful skill that will be helpful going forward. The most challenging part of the lab was getting the plots to look correct, but MATLAB's plotting commands are very intuitive which was nice. No major improvements.