

AERO 422 Homework #2

Instructor: Vedang Deshpande

Due: September 22, 2021 at 12:40p.m.

Fall 2021

(25 Points)

1. Consider the function $f(t) = te^{2t} \sin 3t$

- (a) (2 points) Find the Laplace transform using the table. Mention which entries from the table are being used.
- (b) (1 point) Can we use the F.V.T. to determine $f(\infty)$? Why or why not?

2. Find the inverse Laplace transform using the table and partial fraction expansion. Show your work.

- (a) (2 points)

$$F(s) = \frac{s + 10}{s^2 + 2s + 10}$$

- (b) (3 points)

$$F(s) = \frac{s^2 + 1}{s(s - 1)^3}$$

3. A given system is found to have a transfer function that is

$$\frac{Y(s)}{R(s)} = \frac{10(s + 2)}{s^2 + 8s + 15}$$

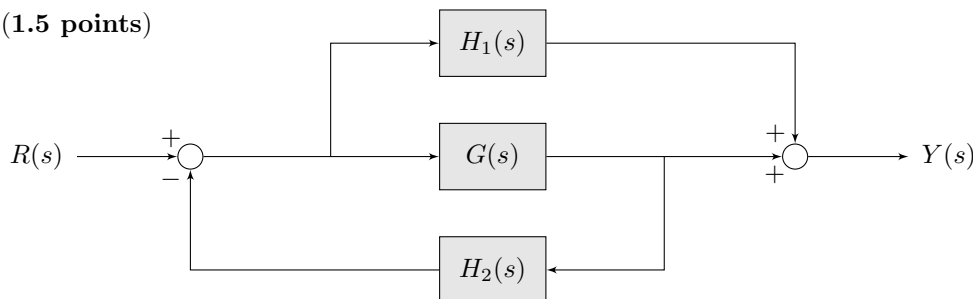
- (a) (3 points) Using partial fractions, determine $y(t)$ when $r(t)$ is a unit step input. Show your work.
- (b) (1 point) Can we use F.V.T. to find $y(\infty)$? If the answer is yes, apply F.V.T. If not, explain why.
4. (a) (3 points) Using the convolution integral, find the step response of the system whose impulse response is given below

$$T(n) = \begin{cases} te^{-t} & t \geq 0 \\ 0 & t < 0 \end{cases}$$

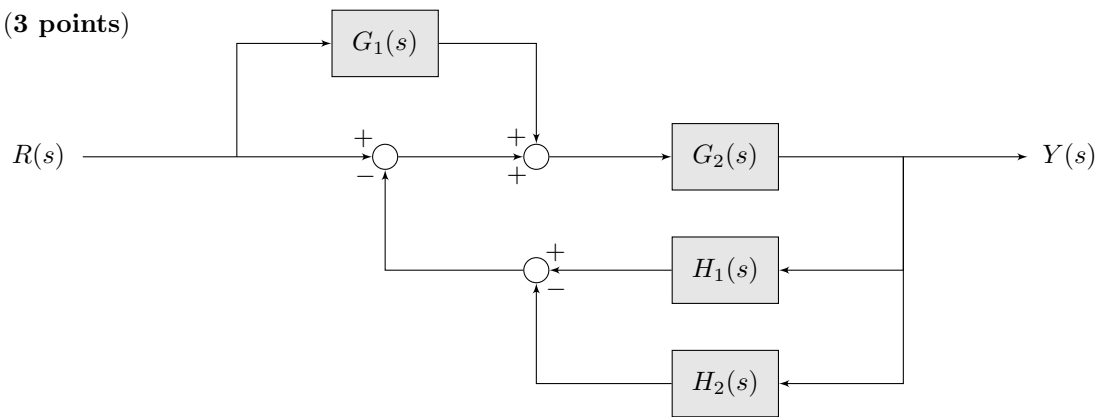
- (b) (2 points) Now use the Laplace transform table and partial fraction expansion to find $y(t)$.
- (c) (2 points) Apply I.V.T. and F.V.T. (if applicable) to find $y(0)$ and $y(\infty)$.

5. For each of the following block diagrams, reduce the block diagram to find $T(s)$, where $T(s)$ is defined by $Y(s) = T(s)R(s)$.

- (a) (1.5 points)



(b) (3 points)



(c) (1.5 points)

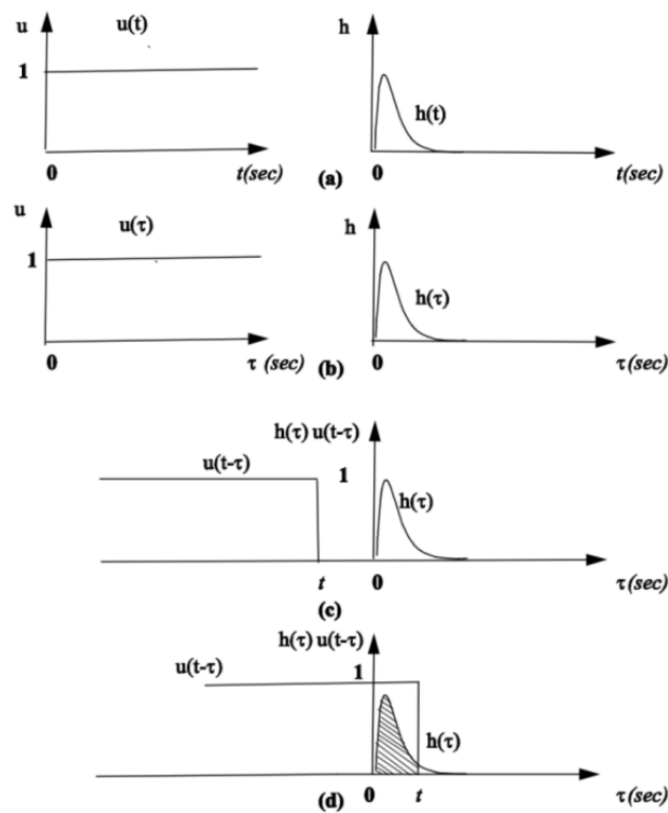
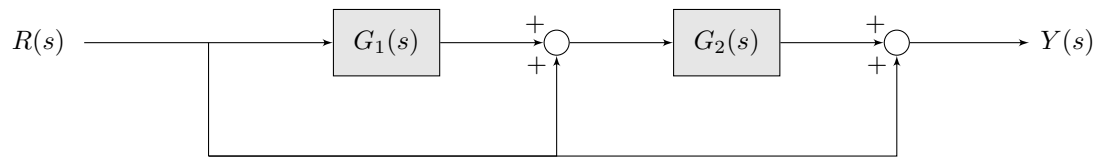


Illustration of convolution.

Figure 1: Convolution integral (reference for problem 4)