

AERO 422 Homework #2

Instructor: Vedang Deshpande

Due: [TBD] at 12:40p.m.

Fall 2021

(TBC 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

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

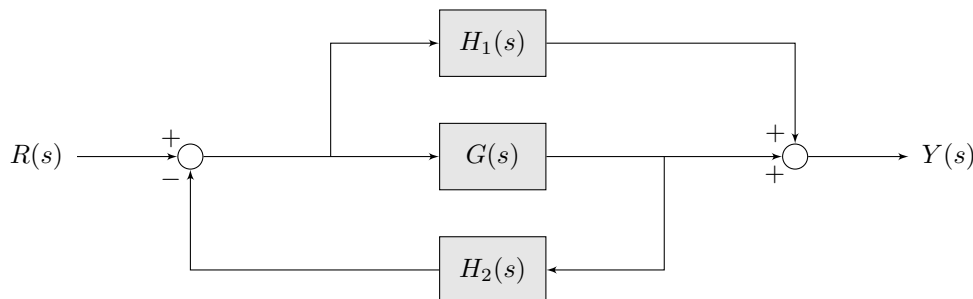
- (a) **(3 points)** Determine, by hand, $y(t)$ when $r(t)$ is a unit step input. Show your work.
 - (b) **(2 points)** Can we use F.V.T. to find $y(\infty)$? If the answer is yes, apply F.V.T. If not, explain why.
4. (a) **(3 points)** Using the convolution integral, find the step response of the system whose impulse response is given below

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

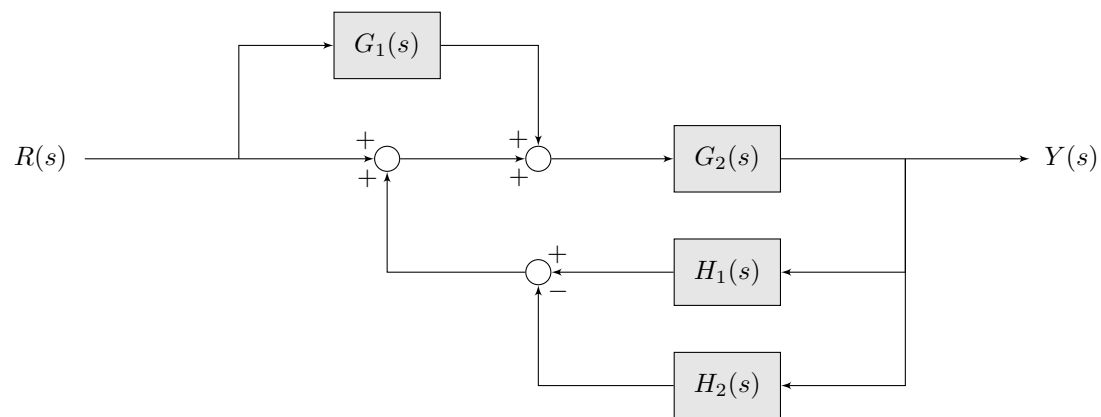
- (b) **(2 points)** Now use the Laplace transform table and partial fraction expansion to find $y(t)$.
- (c) **(2 points)** Apply I.V.T. and F.V.T. (if applicable) to find $y(0)$ and $y(\infty)$.

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)



(b)



(c)

