Presentation 1

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1. Problem
2. Solution
   - Laplace Transform
3. Plot

Problem Statement

Use Matlab or Python to find the laplace tranform of the following time functions.

$$f1(t) = 8t^2 cos(3t + 45^o) \tag{2.1}$$

$$f2(t) = 3texp(-2t)sin(4t + 60^o) \tag{2.2}$$

Where phase is in degree.

Solution

$$\mathrm{f1(t)} = 8\mathrm{t}^2 cos(3t + 45^o)$$

But, we know that

$$cos(A + B) = cosAcosB - sinAsinB \tag{3.1}$$

$$sin(A + B) = sinAcosB + sinBcosA \tag{3.2}$$

So,

$$\mathrm{f}_1(t) = 8t^2(cos3tcos45 - sin3tsin45)$$

Now,

$$f_1(t) = 4\sqrt{2}t^2(cos3t - sin3t) \tag{3.3}$$

Now for 2nd function

$$f_2(t) = 3texp(-2t)sin(4t + 60^o)$$

$$f_2(t) = \frac{3}{2}texp(-2t)(sin4t + \sqrt{3}cos4t) \tag{3.4}$$

.....Using equation 3.2

Laplace Transform

Using table of basic Laplace functions and some properties.

Laplace transform of $f_1(t)$ *is*

$$F_1(s) = 4\sqrt{2}\ \frac{\partial^2\left(\frac{s}{s^2+3^2} - \frac{3}{s^2+3^2}\right)}{\partial s^2}$$

$$F_1(s) = 4\sqrt{2}_1(s) = 4\sqrt{2}\ \frac{\partial\left(\frac{-s^2+6s+9}{(s^2+9)^2}\right)}{\partial s}$$

$$F_1(s) = 8\sqrt{2}\frac{(s^3-s^2-27s+27)}{(s^2+9)^3}$$

$$F_1(s) = 8\sqrt{2}\frac{(-9s^2-s(27-s^2)+27)}{(s^2+9)^3}$$

Laplace Transform

Similarly , for $f_2(t)$

$$F_2(s) = \frac{3}{2} \frac{\partial\left(\frac{4}{(s+2)^2+4^2} + \frac{\sqrt{3}s}{(s+2)^2+4^2}\right)}{\partial s}$$

$$F_2(s) = \frac{3}{2}\left(\frac{-8(s+2)}{((s+2)^2+16)^2} + \frac{\sqrt{3}(16-(s+2)^2)}{((s+2)^2+16)^2}\right)$$

$$F_2(s) = -\frac{(12s+\sqrt{3}(1.5(s+2)^2-24)+24)}{((s+2)^2+16)^2}$$

Plot

The code in

https://github.com/akshay9358/school/blob/master/ControlSystem1.py

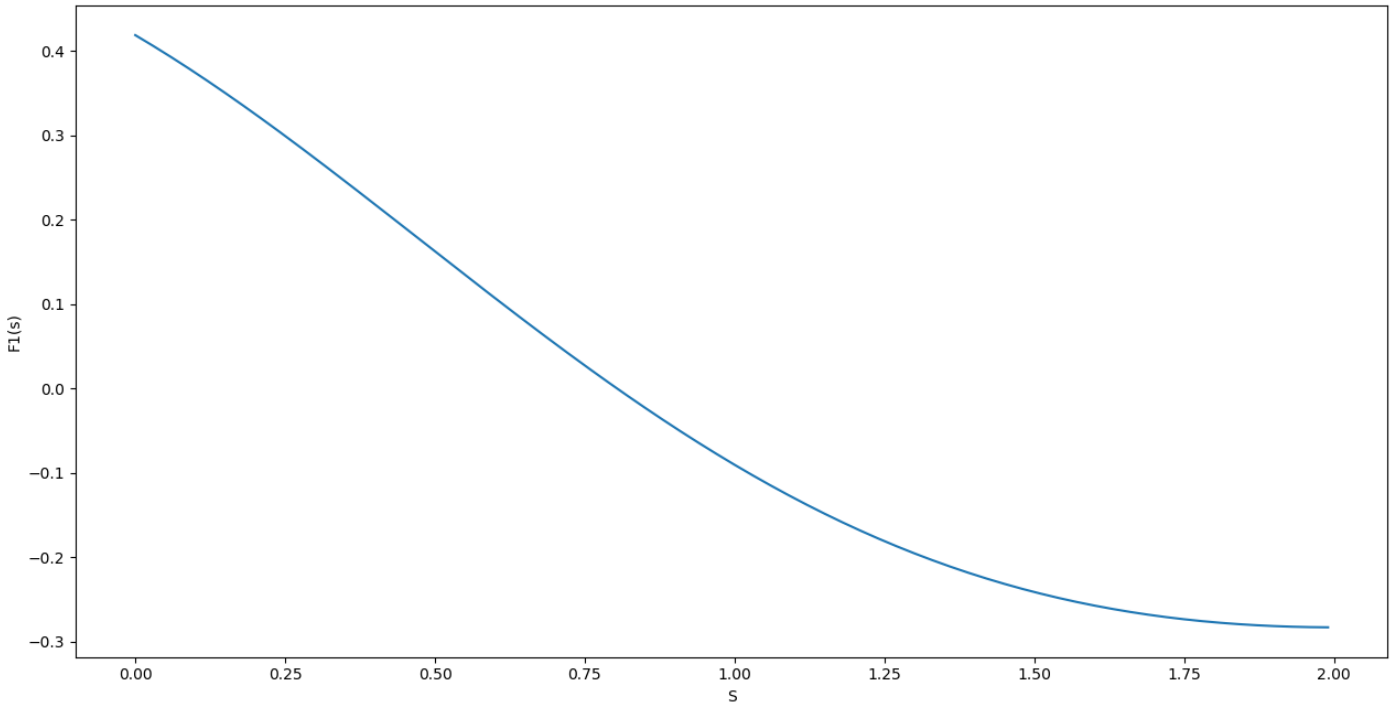


Figure: Plot of F1(s).

Plot

The code in

https://github.com/akshay9358/school/blob/master/ControlSystem1.py

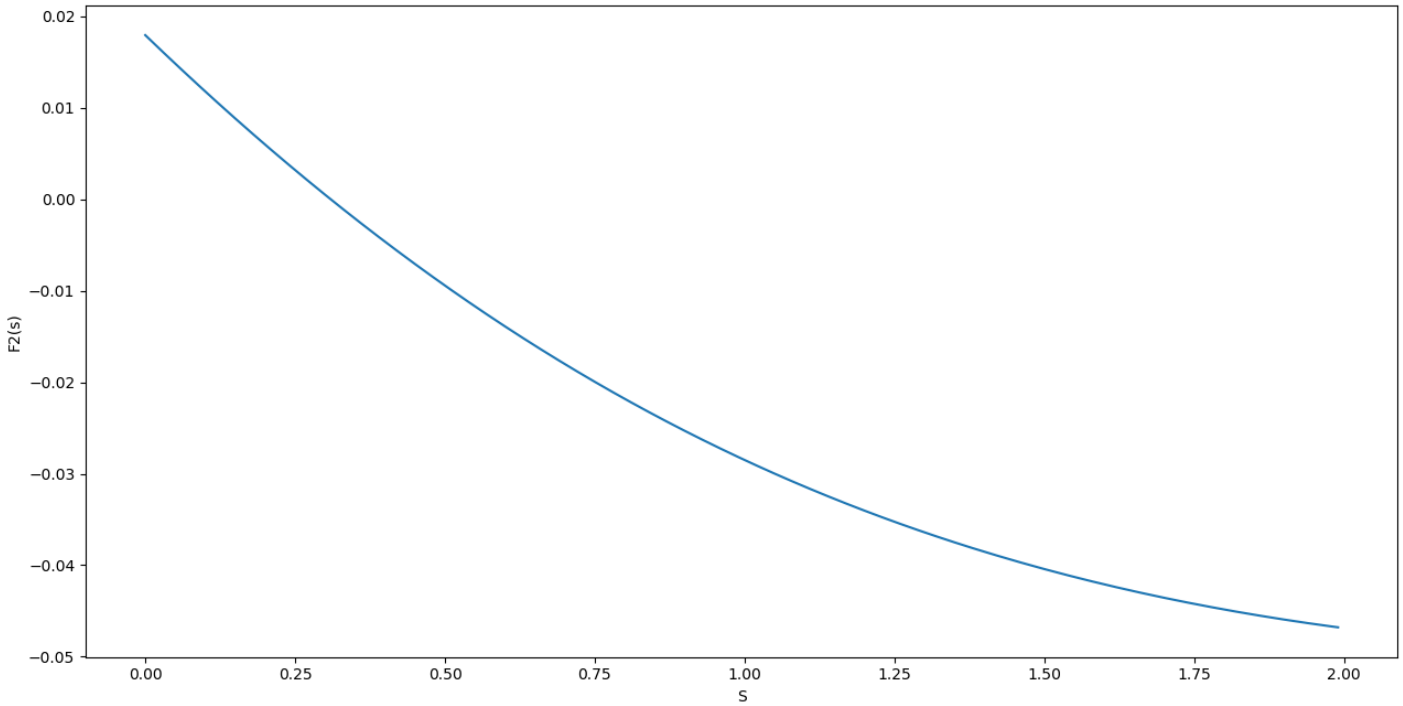
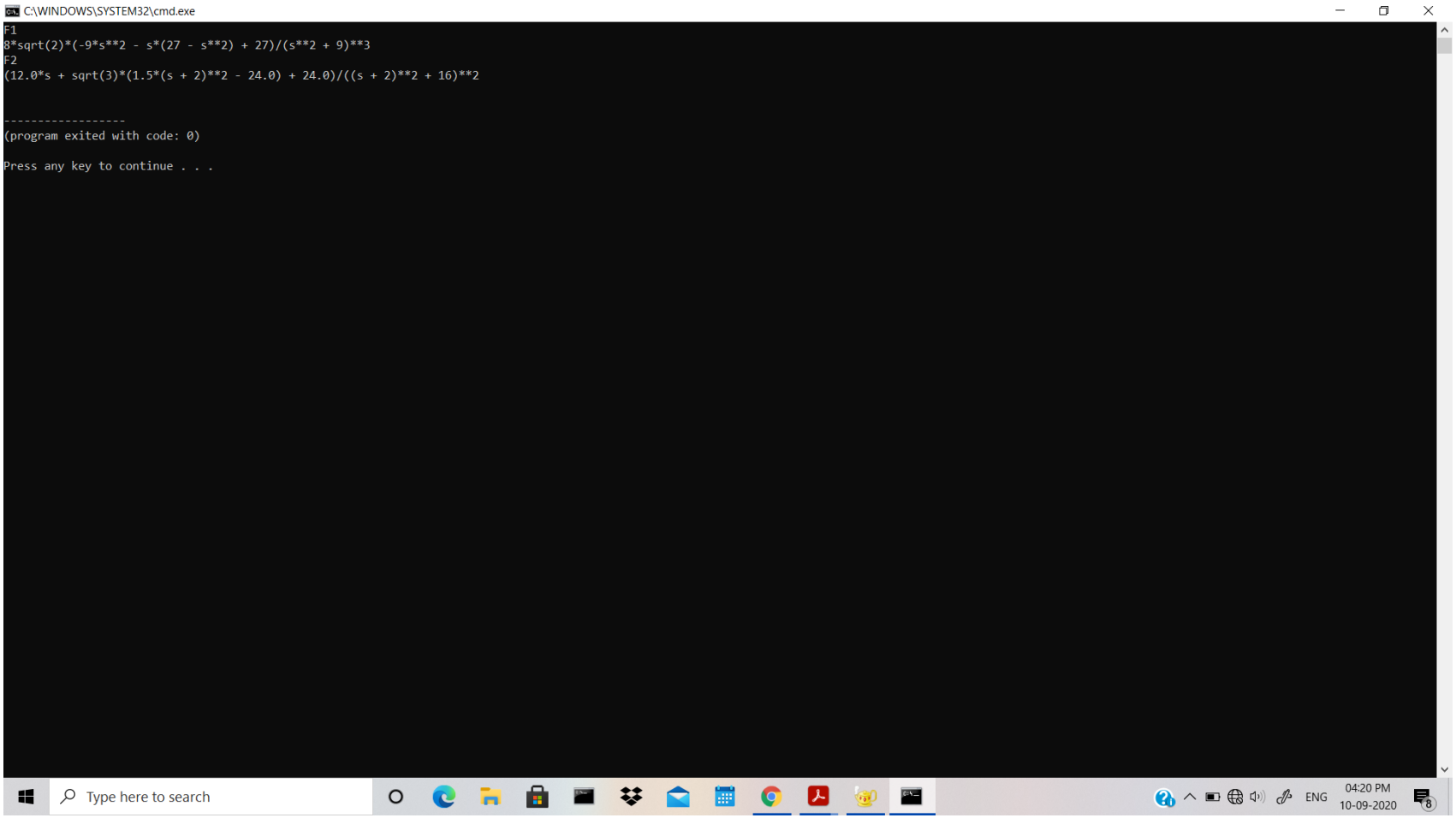


Figure: Plot of F2(s).

Plot

The code in

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