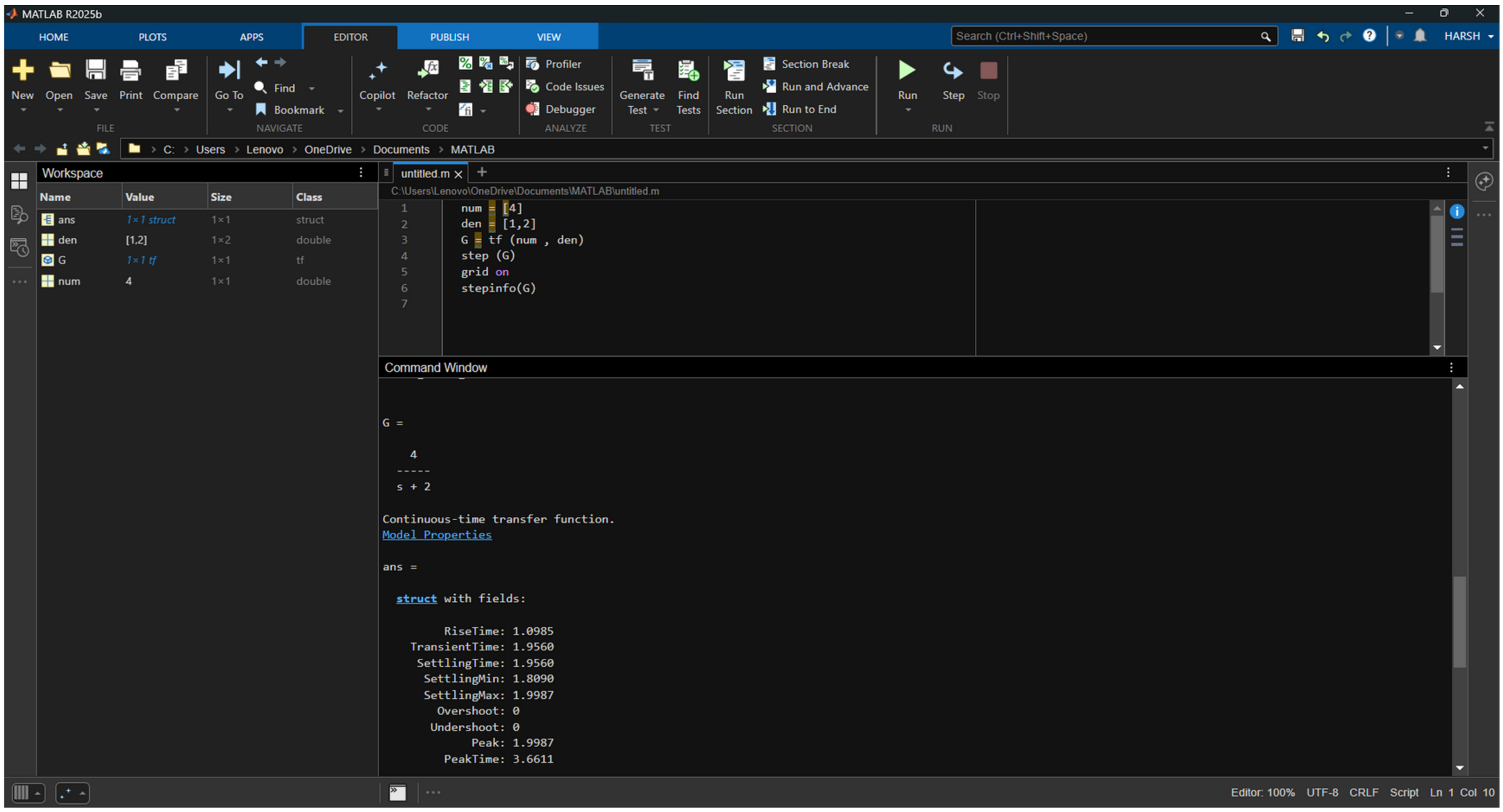
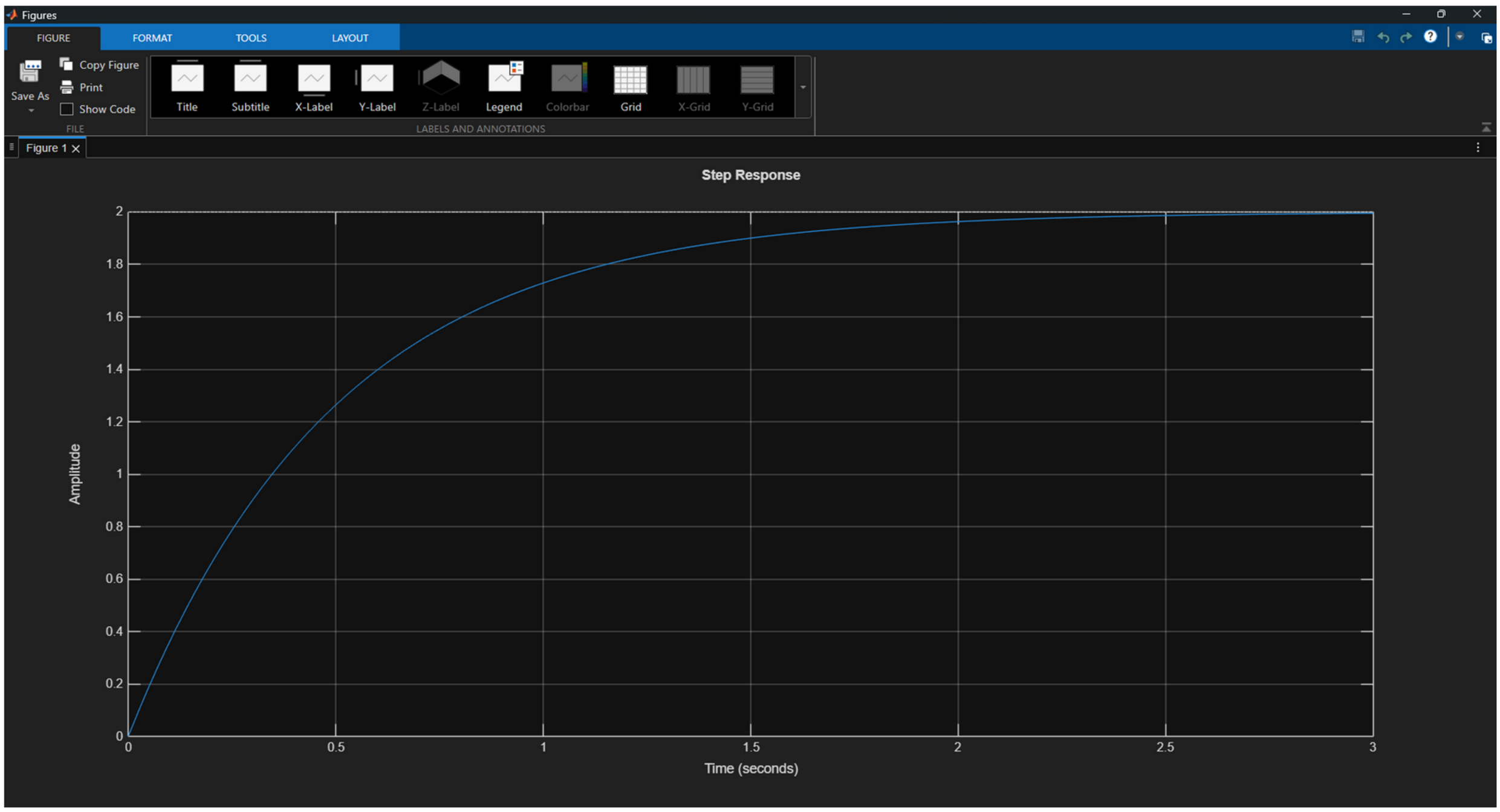




yss = lim s->0 s.G(s).1/s

yss= lims->0 s . 4 . 1 / (s) (s+2)

yss = 2

matches with final matlab output

since it has 1 power of s in denominator , it is a type 1 system also known as integrator .
it has 1 integrator in it .

---

ess = lim s->0 s(1/s - G(s).1/s)

ess = 1 - G(s)

ess = 1 - 10 / s(s+5)

error syeady state = -infinite

FOR CLOSED SYSTEM

ess = lim s->0 (1 - 1/(1+G(s))

=> lim s-> 0 (1 - s(s+5)/10)

ess = 1-1/2

ess = ½

which illustrates the closed systems steady state output is in control and is ½ lower than input

---

since error shoots to - infinte it means the output will shoot to infinite over the period .

ess = 1/(1+k) and ess =0.1

0.1 + 0.1 k = 1

k = 9

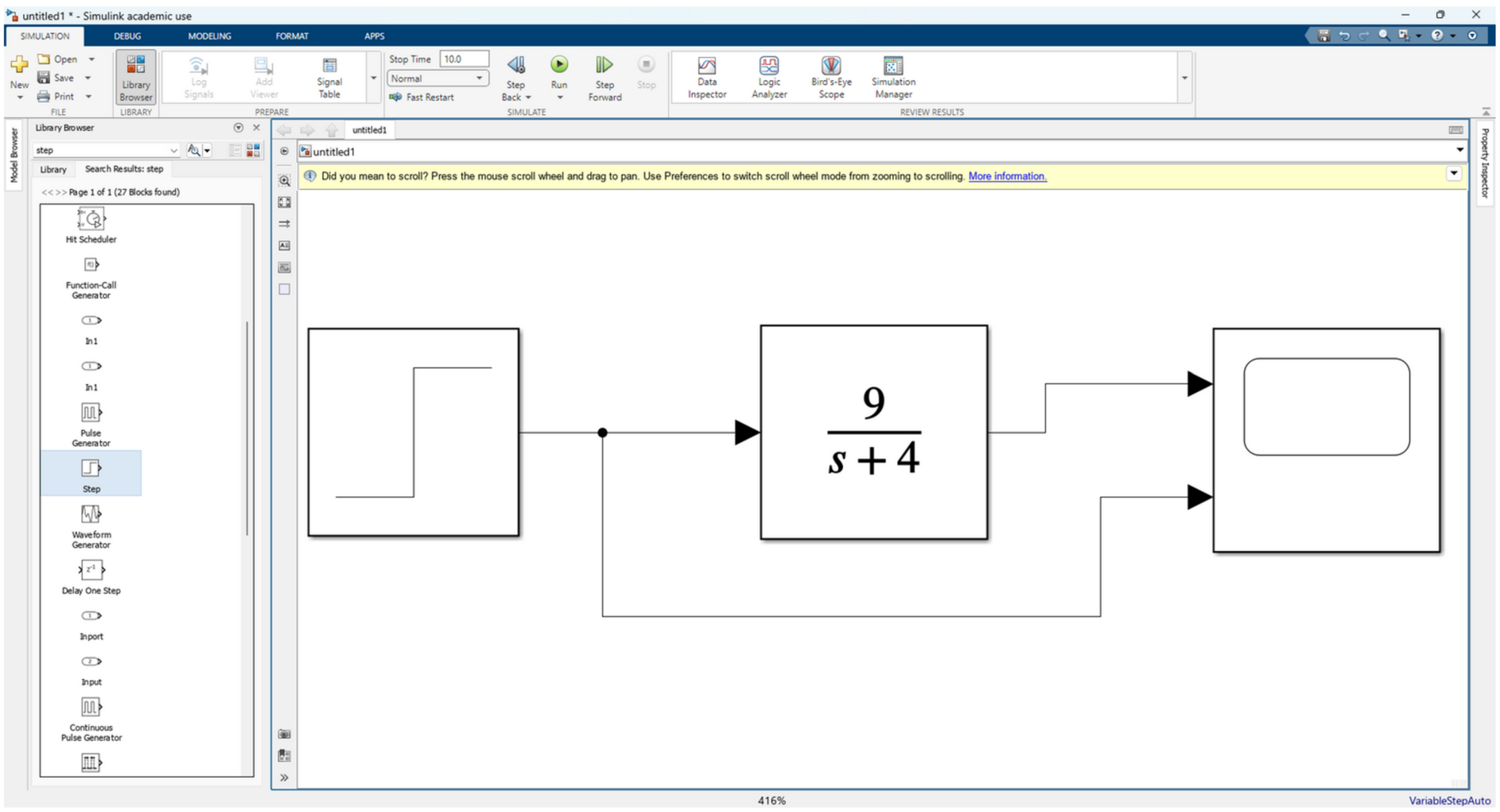
---

ts <1.2 seconds and ts = 4/a

4/a <1.2 seconds

a > 3.3

location of pole is on the real axis on the negative side since pole is - a ;



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1) since settling time is lower than that of 1st problem it is faster than the 1st problem

2) considering k = 9 the final value of the inverse laplace will also have a factor of 9 , so yes the output's final value will be higher

→ $G(s) \Rightarrow \frac{3}{s+1}$

$C(s) \Rightarrow K(s+z)$

Overall Function → $\frac{C(s) \cdot G(s)}{1 + C(s) \cdot G(s)}$
[T]

→ $\frac{\frac{3K(s+z)}{(s+1)}}{1 + \frac{3K(s+z)}{(s+1)}} \Rightarrow \frac{3K(s+z)}{(1+3K)s + (3Kz+1)}$

Seems to be of type zero.

↳ steady state output ⇒ $\lim_{s \to 0} s \cdot (T(s)) \cdot R(s)$

→ First order.

↳ no imaginary poles

↓

no oscillations.

↓

no peak overshoot

so $M_p < 10\%$ automatically satisfied.

$\Rightarrow \lim_{s \to 0} T(s)$ $\quad R(s) \Rightarrow \frac{1}{s}$.

$y_{ss} \Rightarrow \frac{3Kz}{1+3Kz} \Rightarrow 0.8$.

$3Kz \Rightarrow 0.8 + 2.4Kz$

$\boxed{Kz \Rightarrow 4/3}$

→ $t_s \Rightarrow \frac{4}{\alpha}$; $\frac{4}{\alpha} < 2$.

$\frac{4(1+3K)}{(3Kz+1)} < 2$

$\frac{2\cancel{4}(1+3K)}{\cancel{3}} < \cancel{2}$

$3K < \frac{3}{2}$; $K < \frac{1}{2}$; $Kz \Rightarrow \frac{4}{3}$

$\boxed{K \Rightarrow \frac{1}{4} ; z \Rightarrow \frac{16}{3}}$

satisfies.

→ $t_s < 2s$, $M_p < 10\%$; $y_{ss} \Rightarrow 0.8$.

For say $K \Rightarrow \frac{1}{4}$.

→ to dec. rise time

$z \Rightarrow 16/3$

$\boxed{\text{z must be positive so that s+z is ahead of just const. z.}}$

$z \Rightarrow 5$ will work.

→ For $M_p < 10\%$. ; $\xi \Rightarrow \geq 0.59$ or $\boxed{\xi \geq 0.6}$.

$0.1 \Rightarrow e^{-\left(\frac{\xi\pi}{\sqrt{1-\xi^2}}\right)}$

adding a zero increases overshoot

---

since derivative's sign depends on z and which is positive indeed so with increasing k y ss increases

---

with k changing depending on the value of pole ,the rate will be decided .

the open loop response of the close loop system is of type 0 so the answer is of type 0 for with controller and for without controller only transfer function is also a type 0 .

---

for a type zero function the error always comes to be infinite

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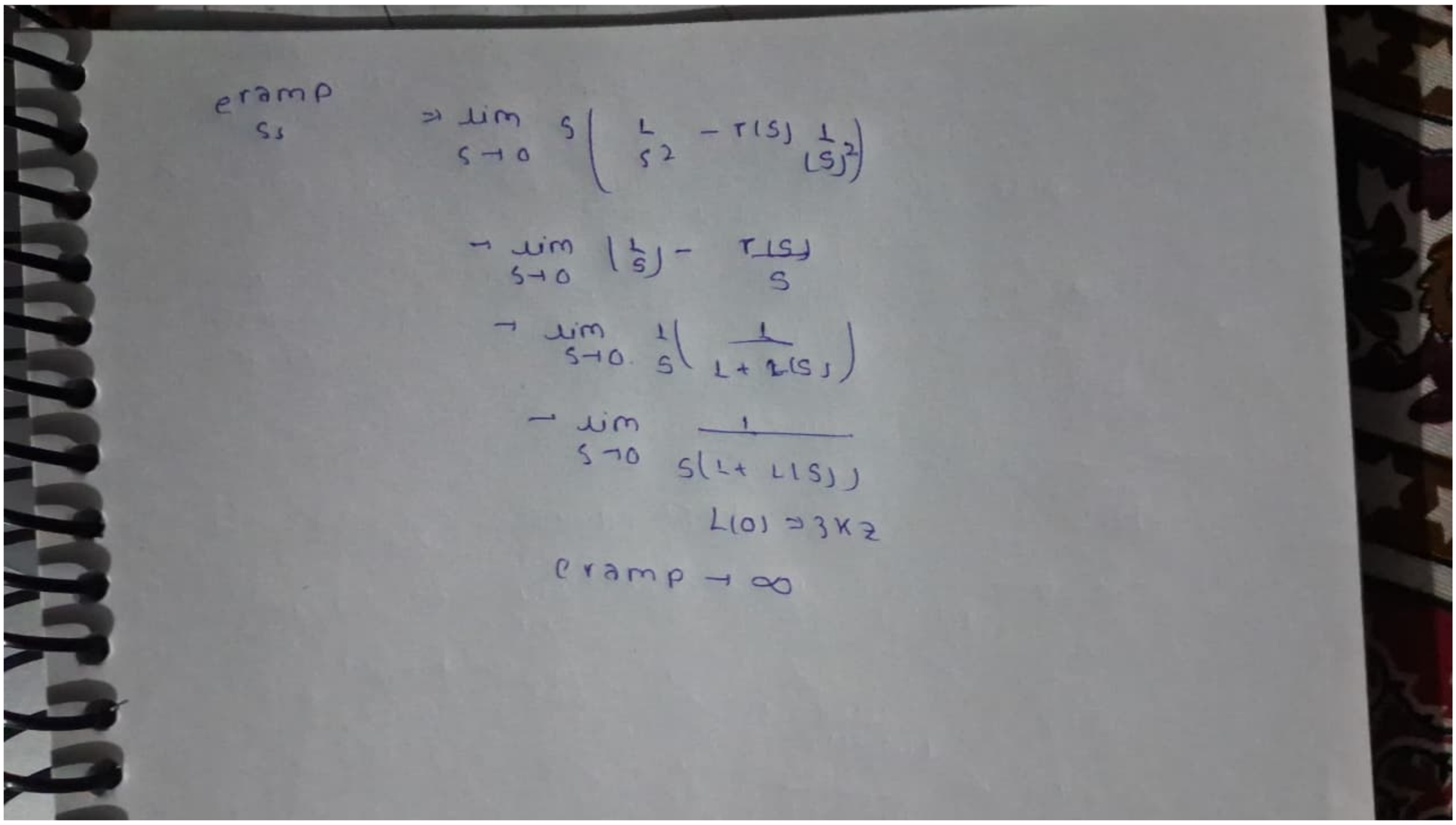

$$e_{ramp_{ss}} \Rightarrow \lim_{s \to 0} s\left(\frac{L}{s^2} - T(s)\frac{1}{(s)^2}\right)$$

$$\to \lim_{s \to 0} \left(\frac{1}{s}\right) - \frac{T(s)}{s}$$

$$\to \lim_{s \to 0} \frac{1}{s}\left(\frac{1}{1+L(s)}\right)$$

$$\to \lim_{s \to 0} \frac{1}{s(1+L(s))}$$

$$L(0) \Rightarrow 3 \times z$$

$$e_{ramp} \to \infty$$

since ramp tracking depends on poles at 0 , to be more precise the integrator part the zero addition would do no change ot the environment

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