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ECE 4850 - Semester Project, Linear Control Systems, November 2011

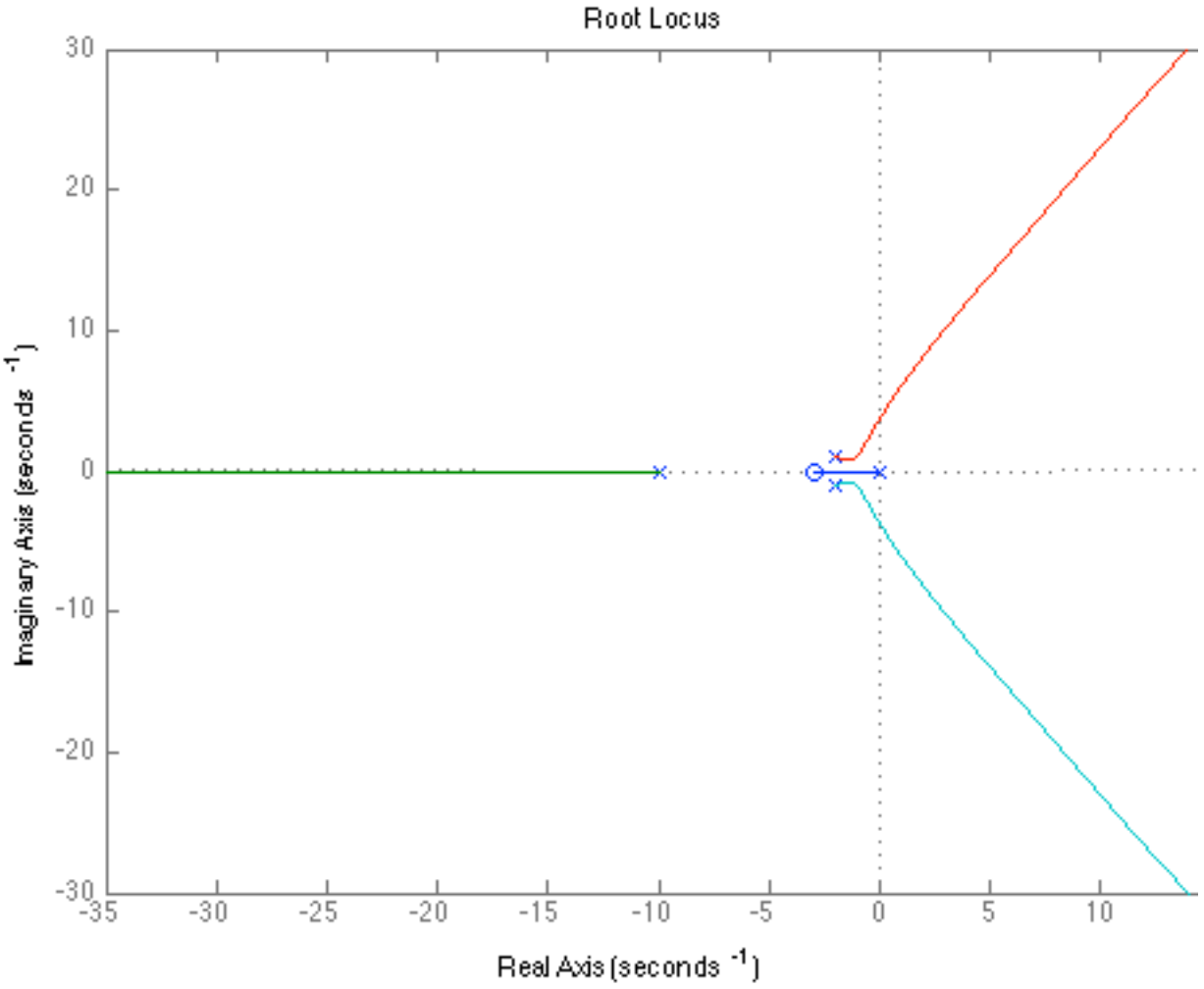
Contents

System Definitions

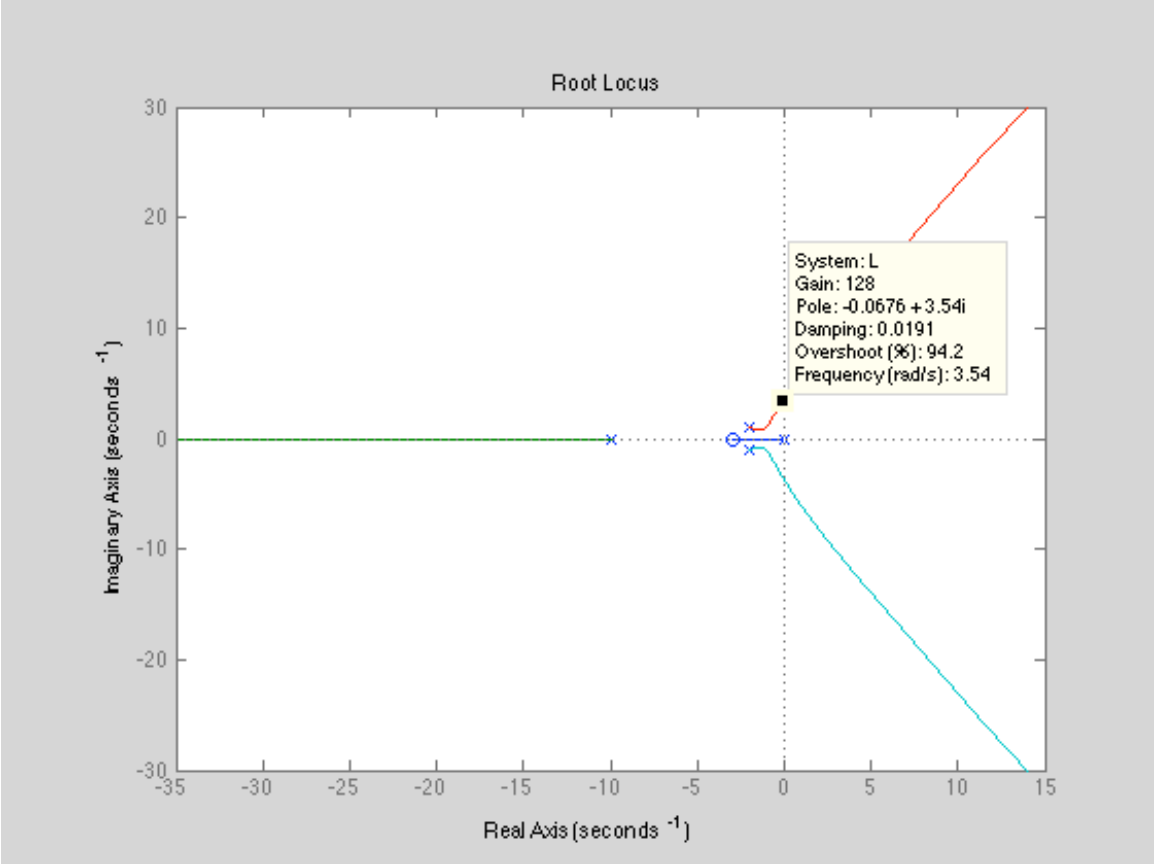
```
K = 1; Ges = tf([K], [1 10]); Gp = tf([1 3], [1 4 5]); Gint = tf([1],
[1 0]); Unity = tf([1],[1]); syms s;
```

Part (b)

```
num = [1 3]; den = conv([1 4 5 0], [1 10]); L = tf(num,den);
figure(1) rlocus(L)
```


Root Locus
Imaginary Axis (seconds -1)
Real Axis (seconds -1)
30
20
10
0
-10
-20
-30
-35
-30
-25
-20
-15
-10
-5
0
5
10

Part (c)

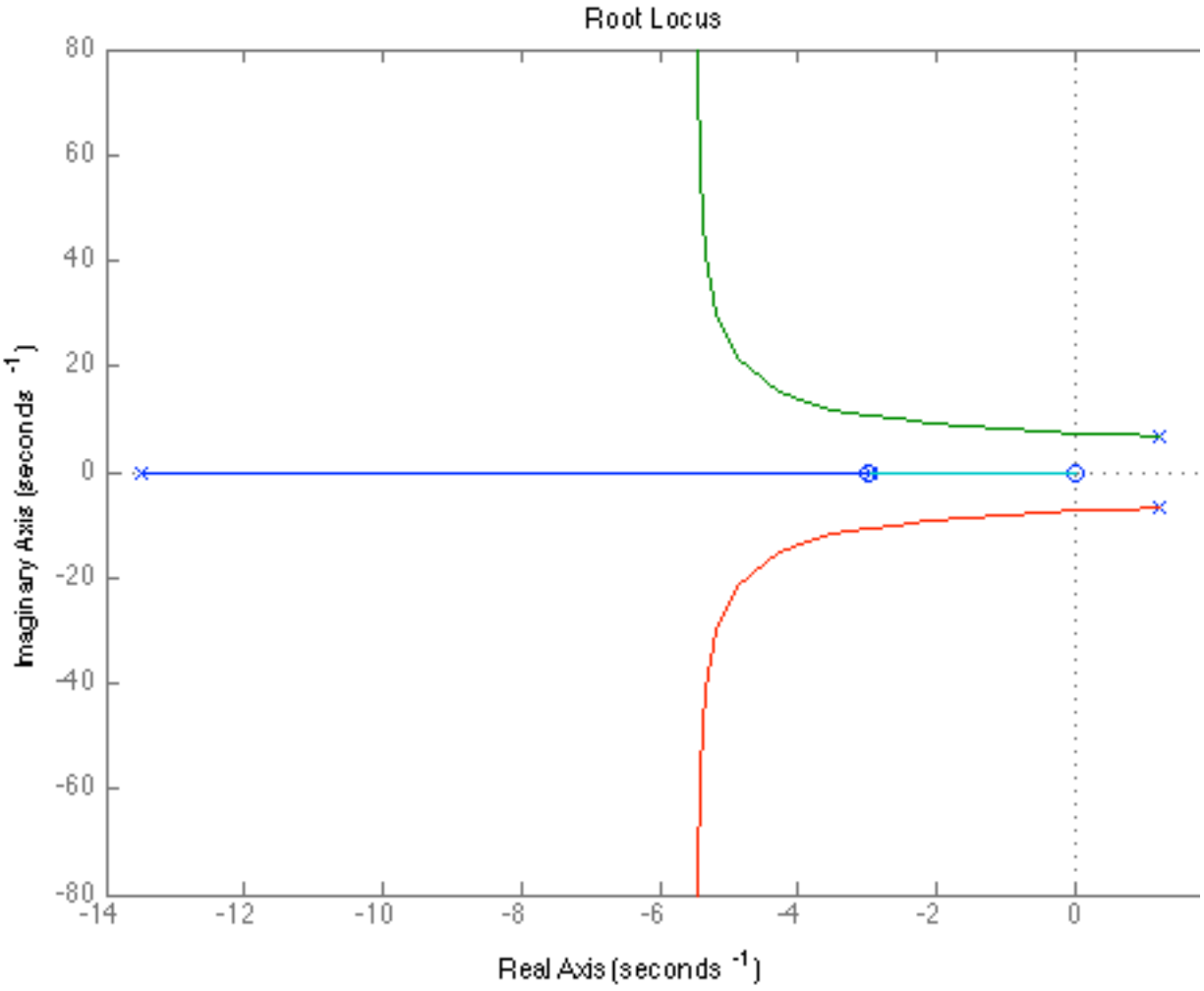


Part (d): K = 600

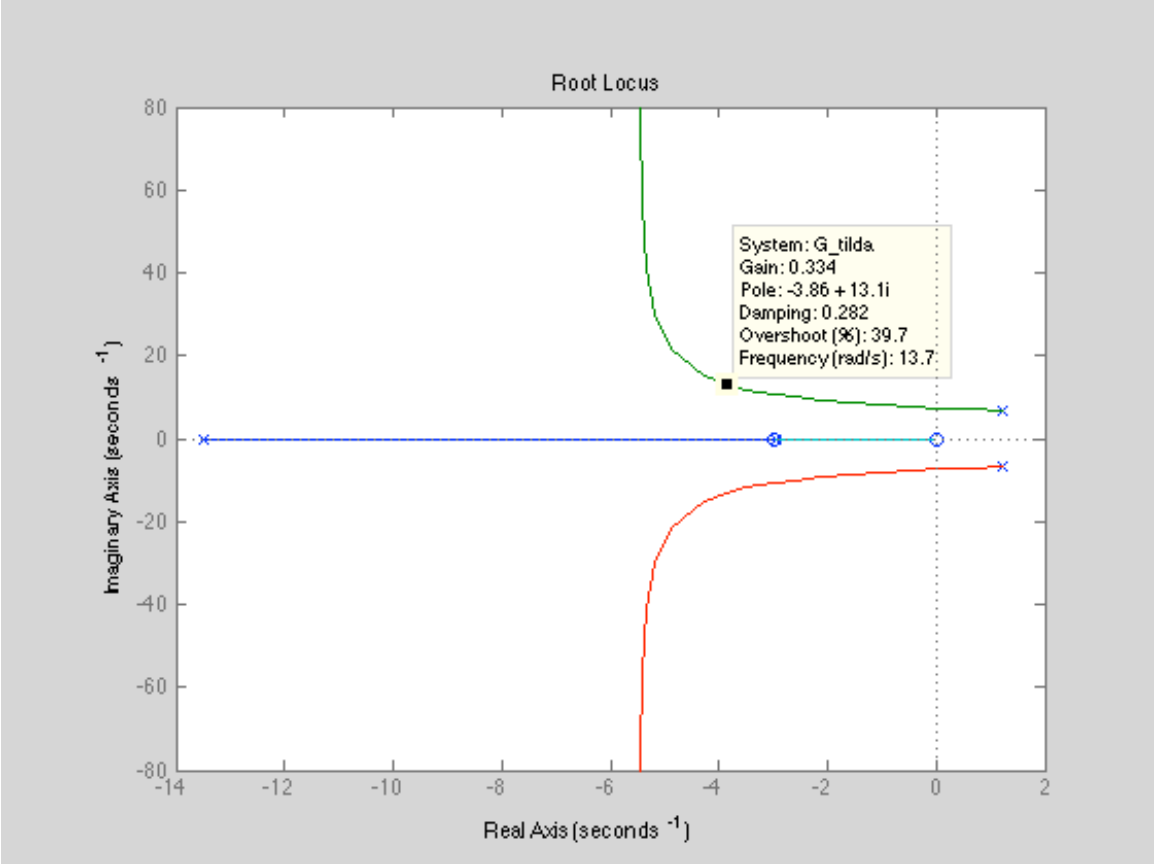
```
K = 600; a_s = [1 14 45 50+K 3*K]; roots(a_s)
 ans =   -13.5014               1.2183 + 6.6284i    1.2183 - 6.6284i
-2.9352
```

Part (f): K = 600, M_p = 0, K_T connected in negative feedback.

```
K = 600; G_tilda = tf([600 1800 0], a_s); figure(2) rlocus(G_tilda)
```

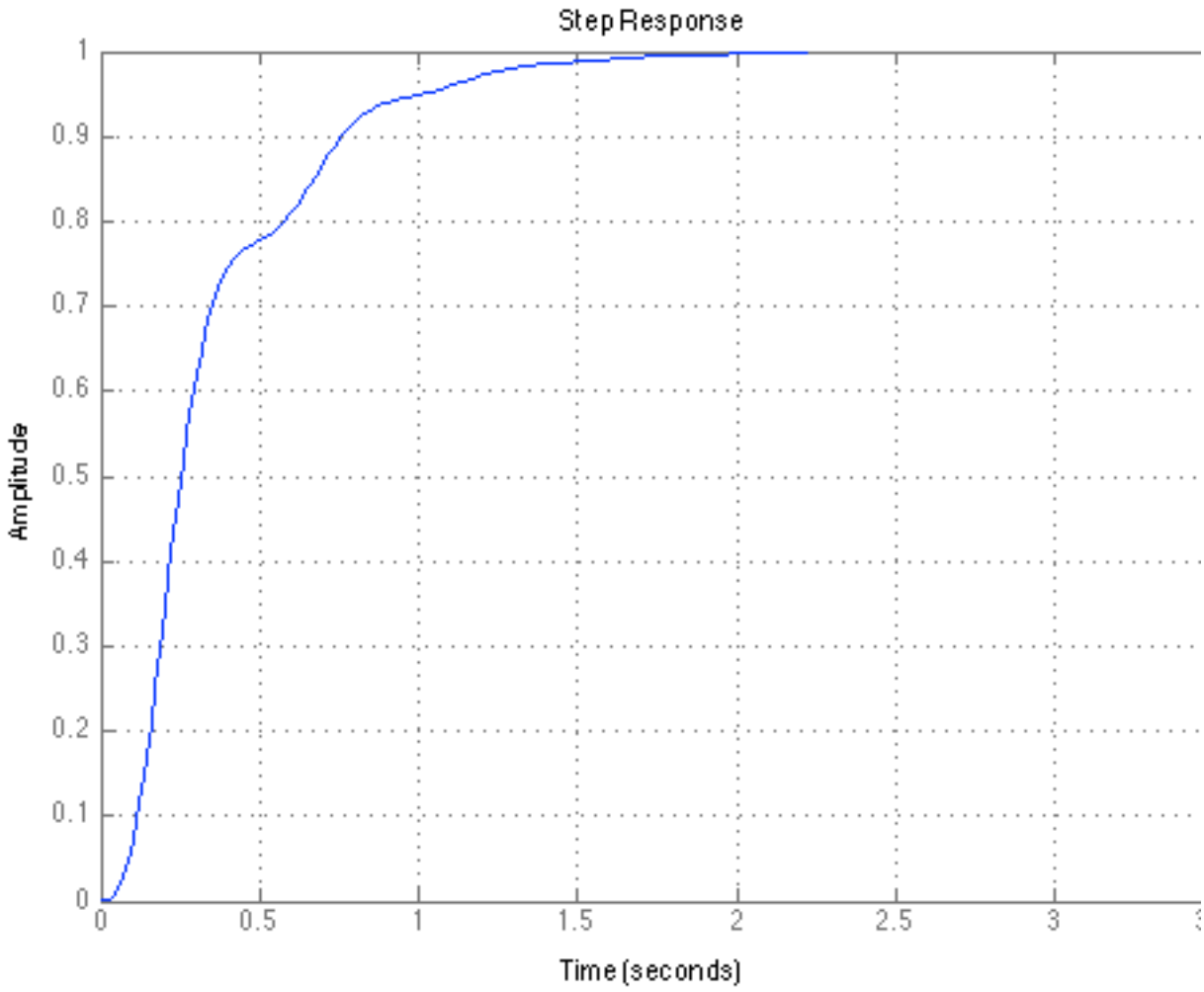


Part (g): K = 600, M_p = 0, K_T connected in negative feedback.
Finding Maximum Damping Factor



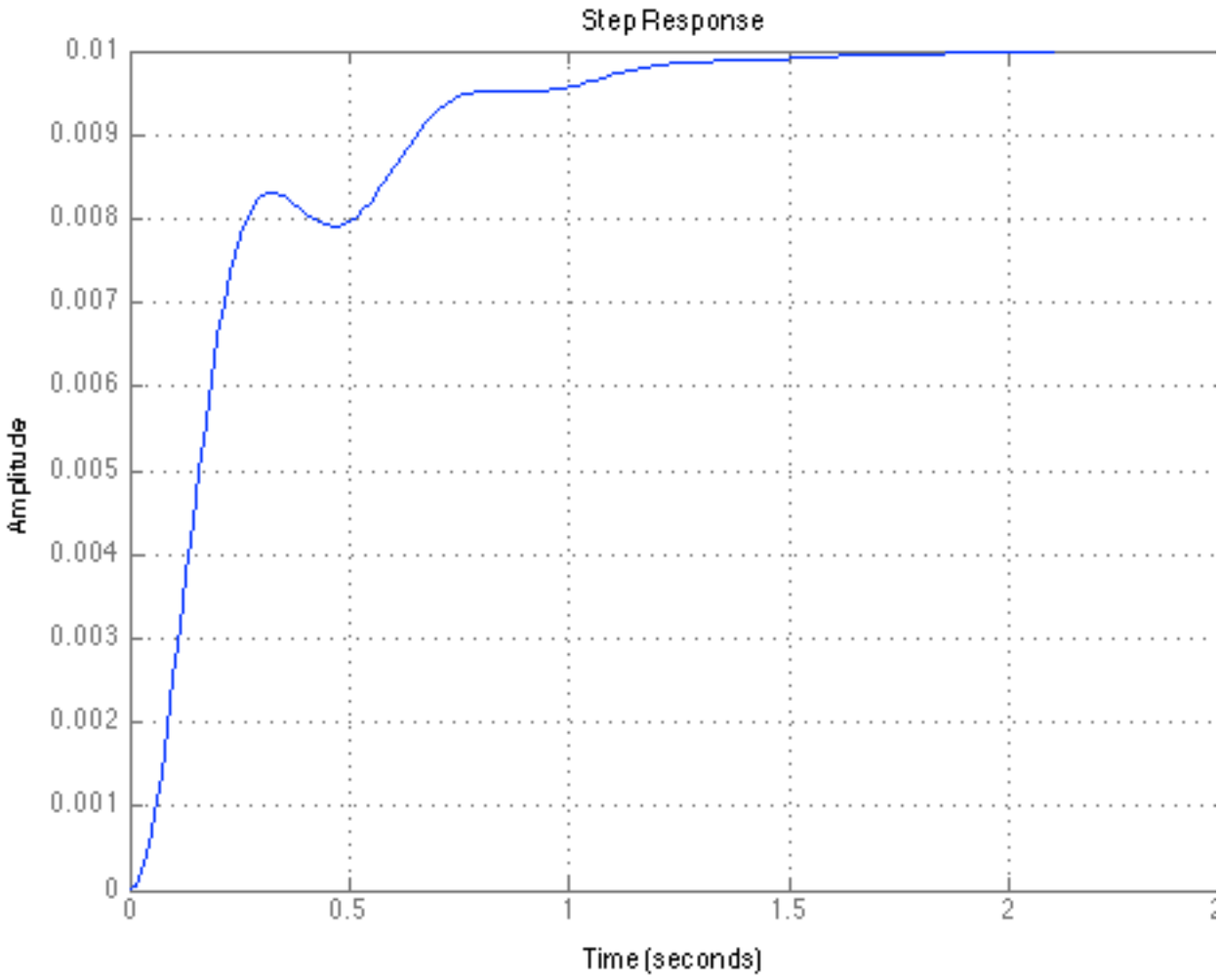
Part (i:<1>): K = 600, K_T = 0.334

```
K_T = 0.334; den = sym2poly((s*(s+10)*(s^2+4*s+5)) +
(K*(s+3)*(1+K_T*s)) ); num = [600 1800]; G_i1 = tf(num,den);
figure(3); step(G_i1); grid on;
```



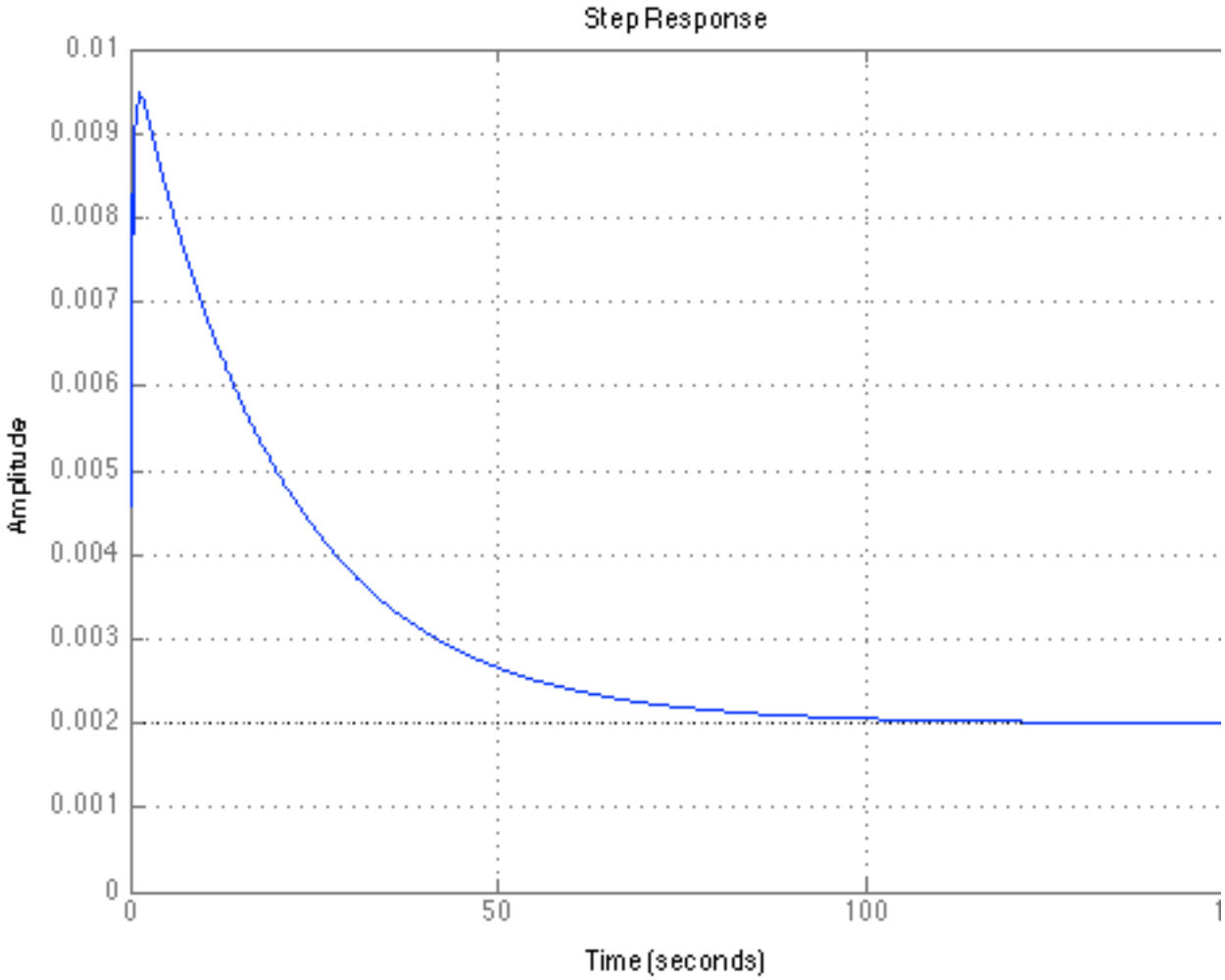
Part (i:<2>): K = 600, K_T = 0.334, M_p = 0.6, theta_r = 0

```
den = sym2poly( (s*(s^2+4*s+5)*(s+10)) + (K_T*s*K*(s+3)) + (K*(s+3))
); num = conv([1 3], [1 10]); G_i2 = tf(num, den); figure(4);
step(0.6*G_i2); grid on;
```



Part (i:3:IV): K = 600, K_T = 0.334, M_p = 0.6, theta_r = 0

```
den = sym2poly( (s*(s^2+4*s+5)*(s+10)*(s+0.01)) +
(K_T*s*K*(s+3)*(s+0.05) + (K*(s+3)*(s+0.05))) ); num = conv(conv([1
3], [1 10]), [1 0.01]); G_i3 = tf(num, den); figure(5);
step(0.6*G_i3); grid on;
```



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