EE302 Homework 3

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a)

```
p1 = [1 20 10 400];
p2 = [1 3 2 6 3 1];
p3 = [1 -1 2 -4 -8];
p4 = [1 2 16 32 100 200];
roots1 = roots(p1);
roots2 = roots(p2);
roots3 = roots(p3);
roots4 = roots(p4);
```

Results are (in 2 significant digit); polynomial 1 has roots at
$\lambda_1 = -20,47 + 0,00i$
$\lambda_2 = 0,23 + 4,41i$
$\lambda_3 = 0,23 - 4,41i$
I expect two positive pole from routh-hurwitz test. Result make sense.

polynomial 2 has roots at
$\lambda_1 = -2,91$
$\lambda_2 = 0,23 + 1,33i$
$\lambda_3 = 0,23 - 1,33i$
$\lambda_4 = -0,28 + 0,34i$
$\lambda_5 = -0,28 - 0,34i$

From Routh-Hurwitz test i expect 2 positive pole. Matlab result consistent.

polynomial 3 has roots at
$\lambda_1 = 2.00$
$\lambda_2 = 2.00i$
$\lambda_3 = -2.00i$
$\lambda_4 = -1.00$
From Routh-Hurwitz test i expect two poles on jw axis and one pole at RHP. Matlab results make sense.

polynomial 4 has roots at
$\lambda_1 = 1,00 + 3,00i$
$\lambda_2 = 1,00 - 3,00i$
$\lambda_3 = -1,00 + 3,00i$
$\lambda_4 = -1,00 - 3,00i$
$\lambda_5 = -2,00$
From Routh-Hurwitz test i expect two RHP poles with quadrantal pair at LHP. Matlab result are same.

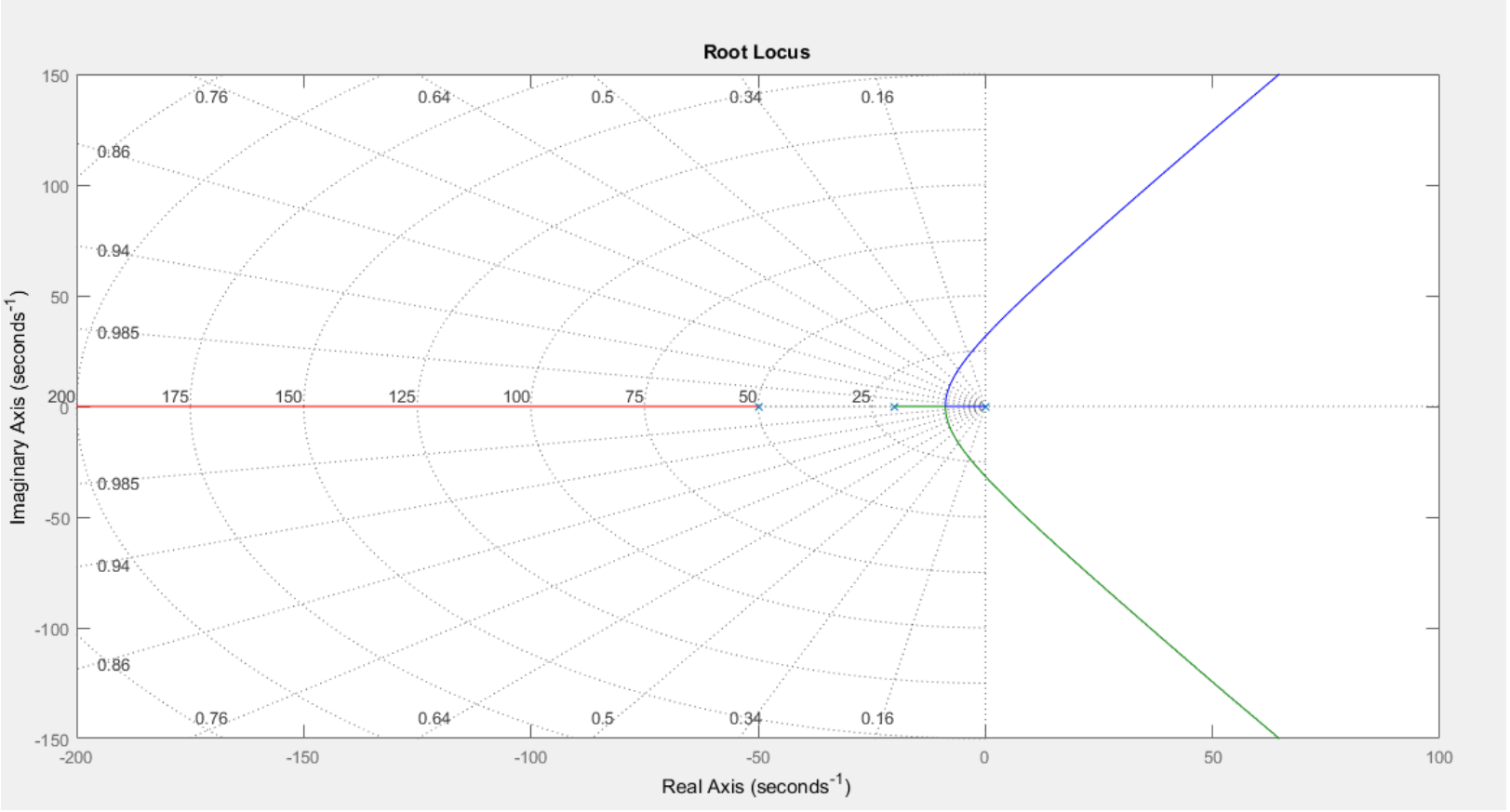
Root Locus
Imaginary Axis (seconds^{-1})
Real Axis (seconds^{-1})
150
100
50
0
-50
-100
-150
-200
-150
-100
-50
0
50
100
0.76
0.64
0.5
0.34
0.16
0.86
0.94
0.985
175
150
125
100
75
50
25

Figure 1: 3a

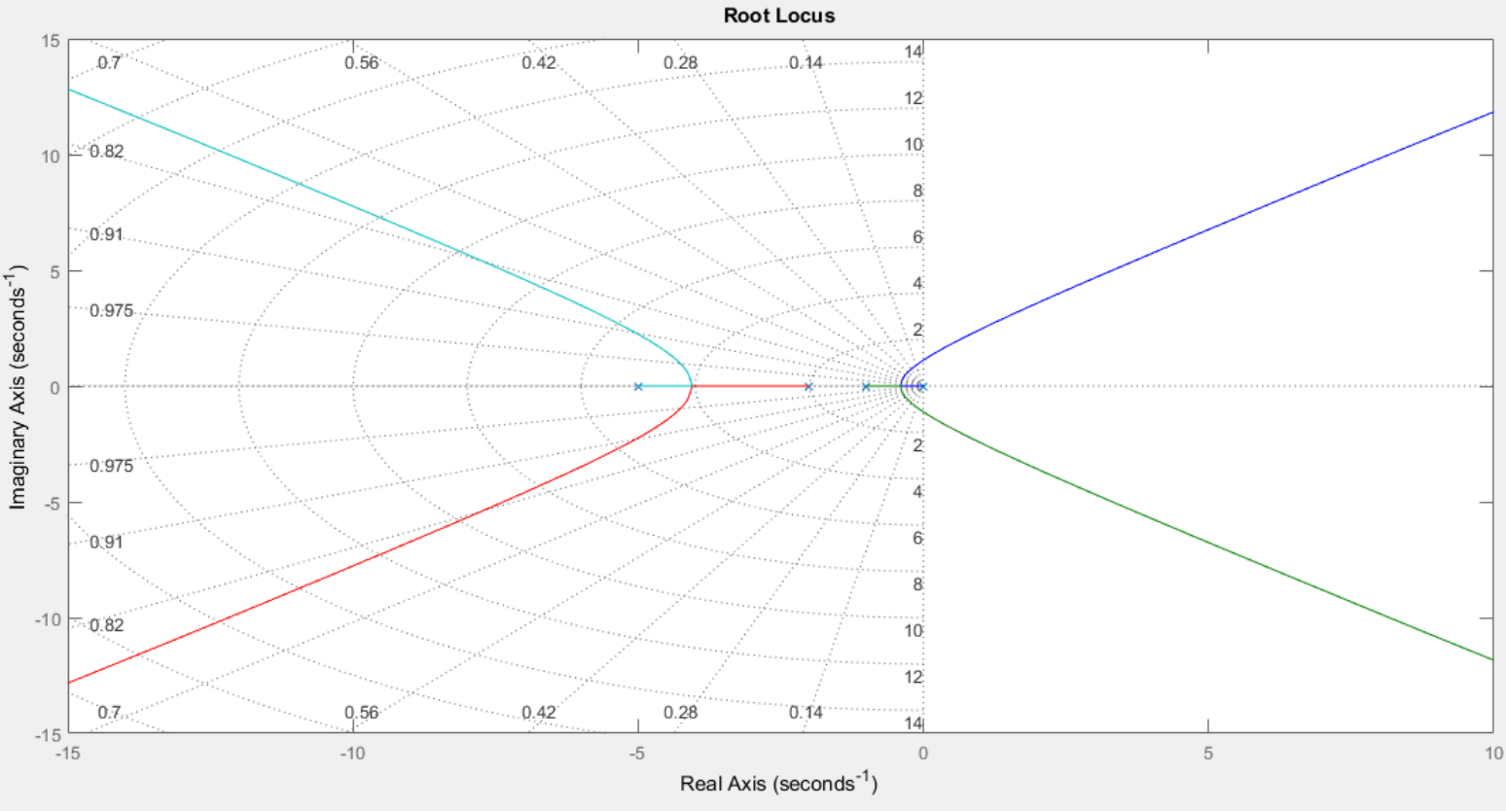
Root Locus
Imaginary Axis (seconds^{-1})
Real Axis (seconds^{-1})
0.7
0.56
0.42
0.28
0.14
0.82
0.91
0.975
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
14
12
10
8
6
4
2

Figure 2: 3b

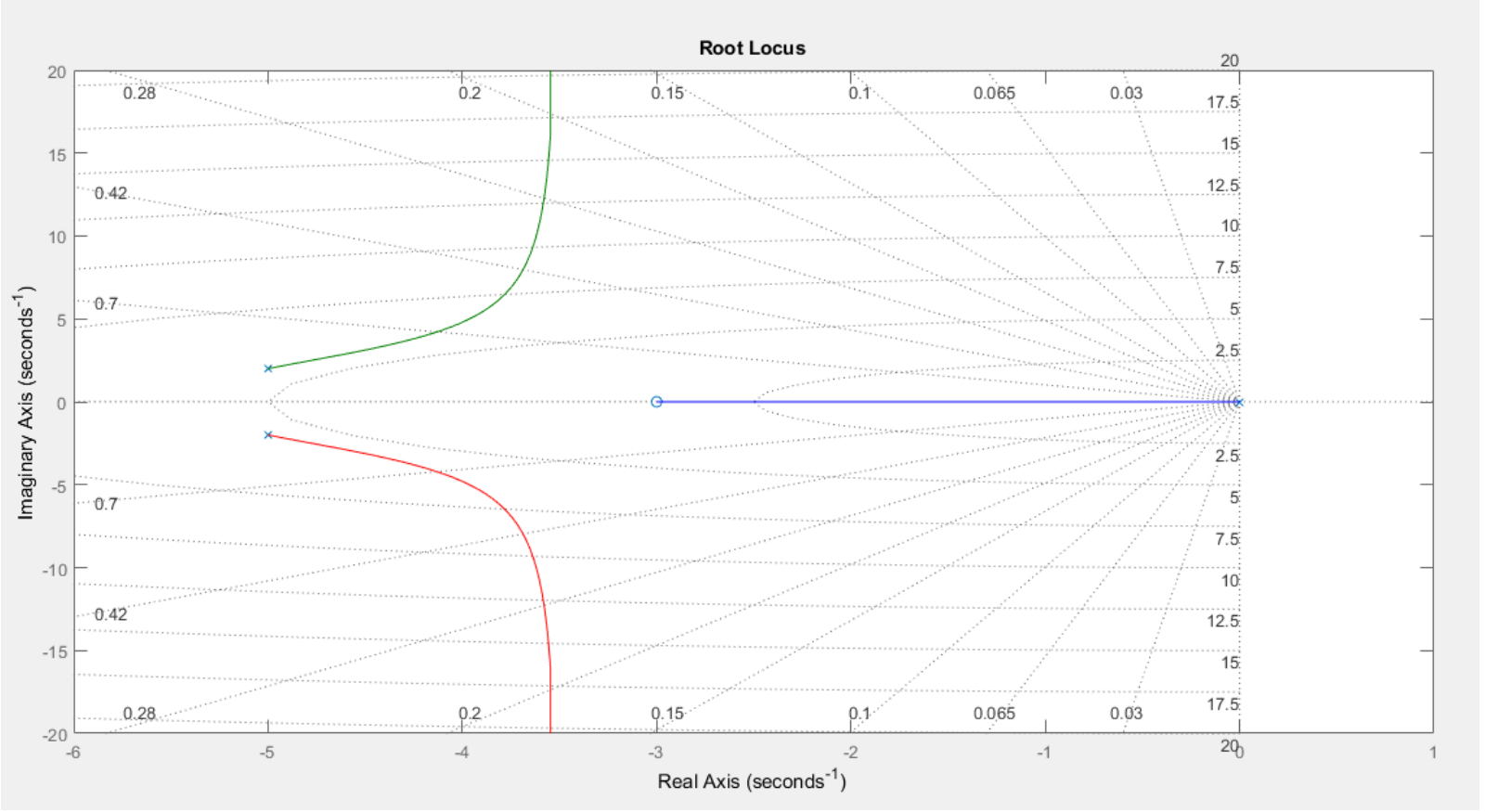
Root Locus
Imaginary Axis (seconds^{-1})
Real Axis (seconds^{-1})
0.28
0.2
0.15
0.1
0.065
0.03
0.42
0.7
20
17.5
15
12.5
10
7.5
5
2.5
20
15
10
5
0
-5
-10
-15
-20
-6
-5
-4
-3
-2
-1
0
1

Figure 3: 3c

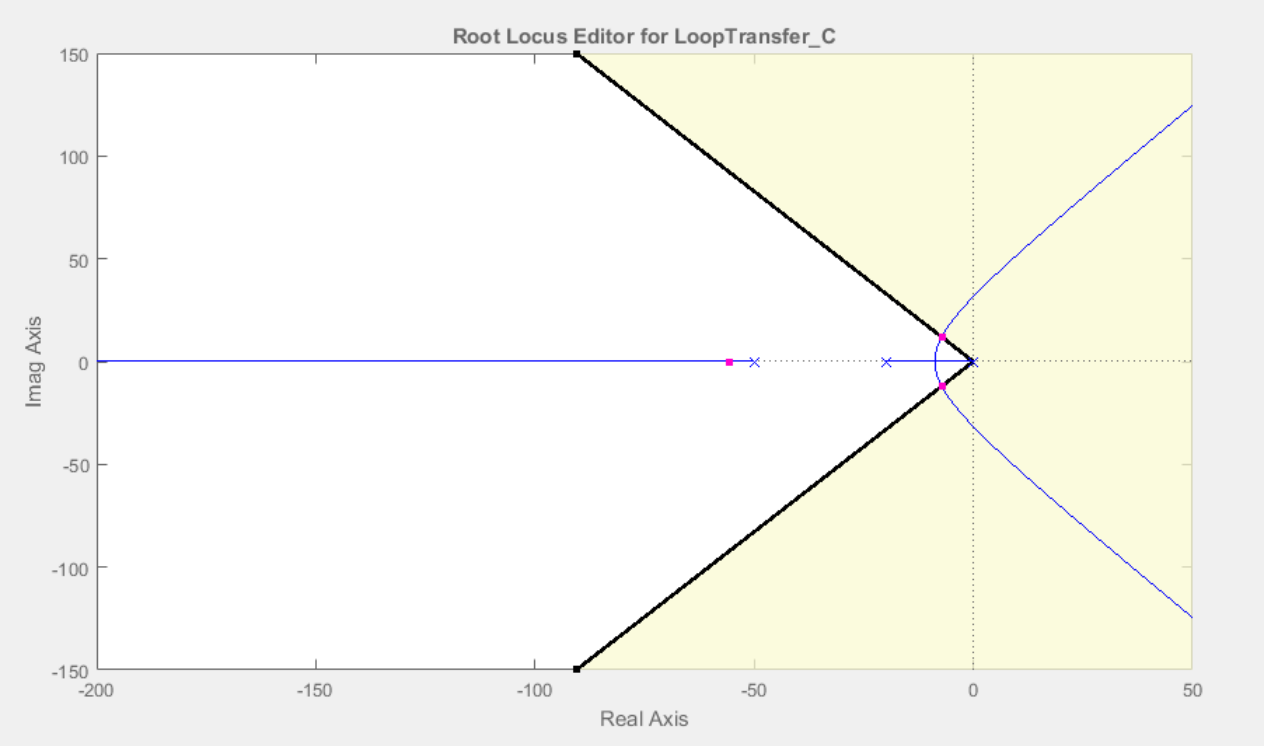

Figure 4: root locus

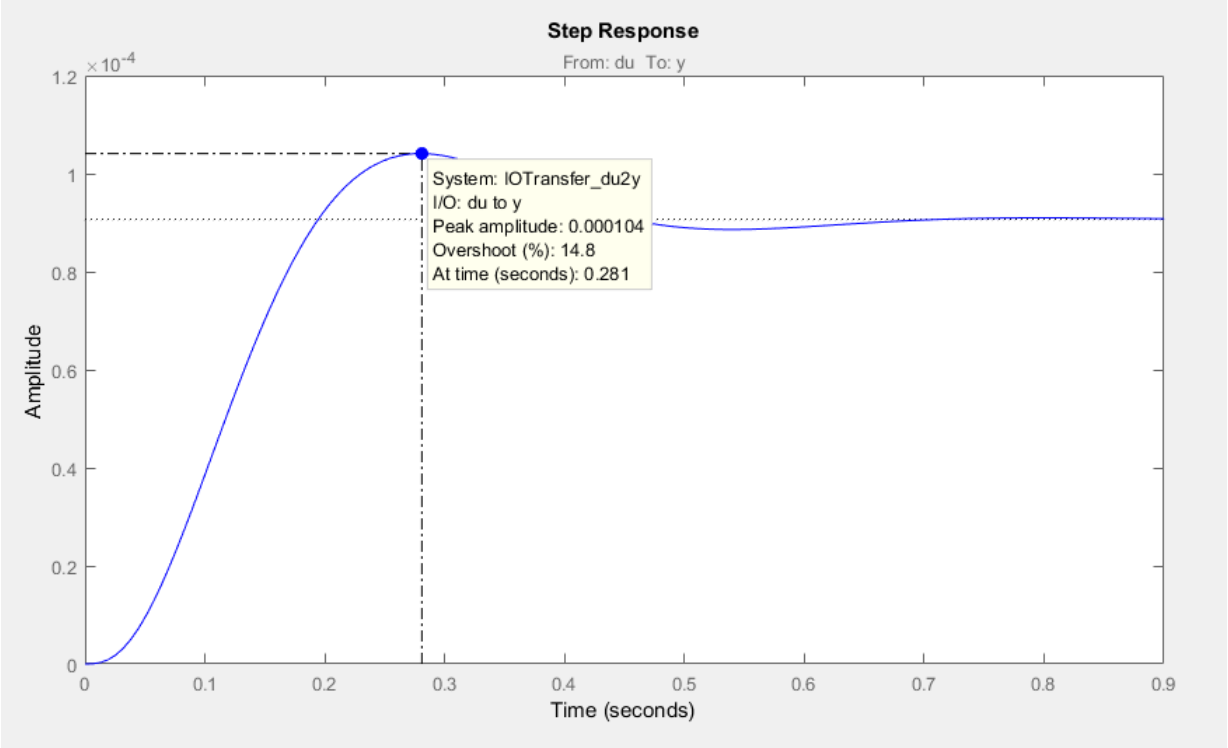

Figure 5: step response