Table of Contents

```
% DS rldesign.22

G = zpk([-20], [-10, -4, -1], 10)

Tr = 0.2;
OS = 25;

zeta = -log(OS / 100) / sqrt(pi^2 + log(OS / 100)^2)


G =

      10 (s+20)
  ------------------
  (s+10) (s+4) (s+1)

Continuous-time zero/pole/gain model.


zeta =

    0.4037
```

From table exact.2

```
wn = 1.25 / Tr

wd = wn * sqrt(1 - zeta^2);

phi = -zeta * wn + wd * i


wn =

    6.2500


phi =

  -2.5232 + 5.7180i
```
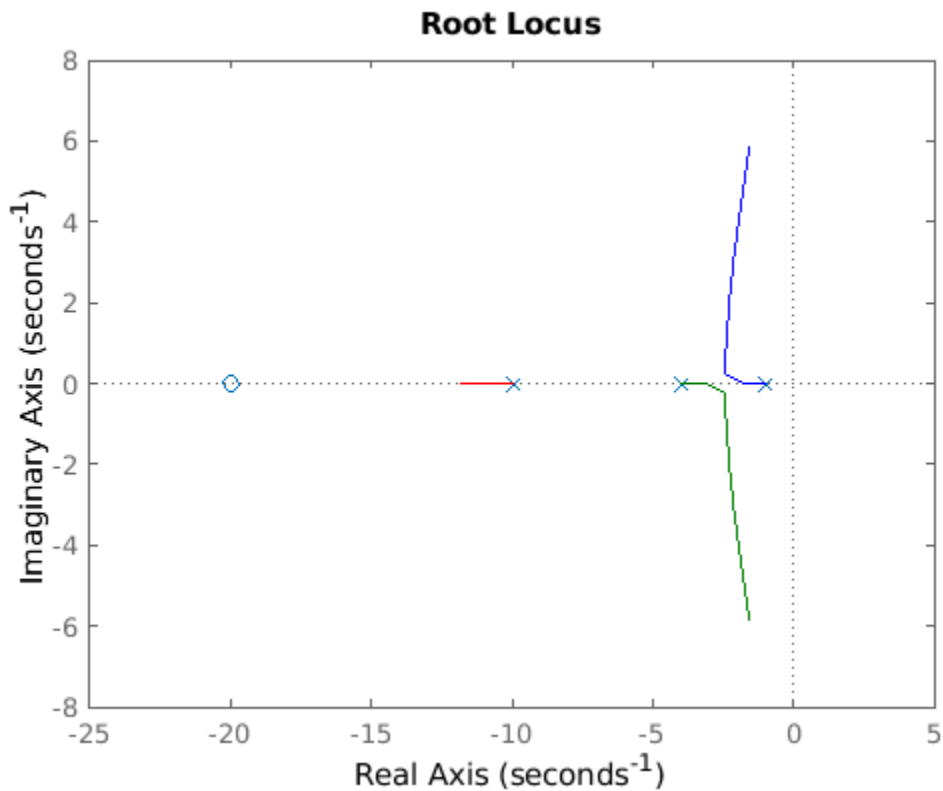
Proportional Control Design

```
rlocus(G, 0:0.02:2)

K1 = 1.03;
```

Root Locus

Derivative Control Design

```
theta_c = pi - angle(evalfr(G, phi))
zc = real(phi) - imag(phi) / tan(theta_c)

Gc = zpk([zc], [], 1)

rlocus(Gc * K1 * G, 0:0.002:0.5)

K2 = 0.102
```

theta_c =

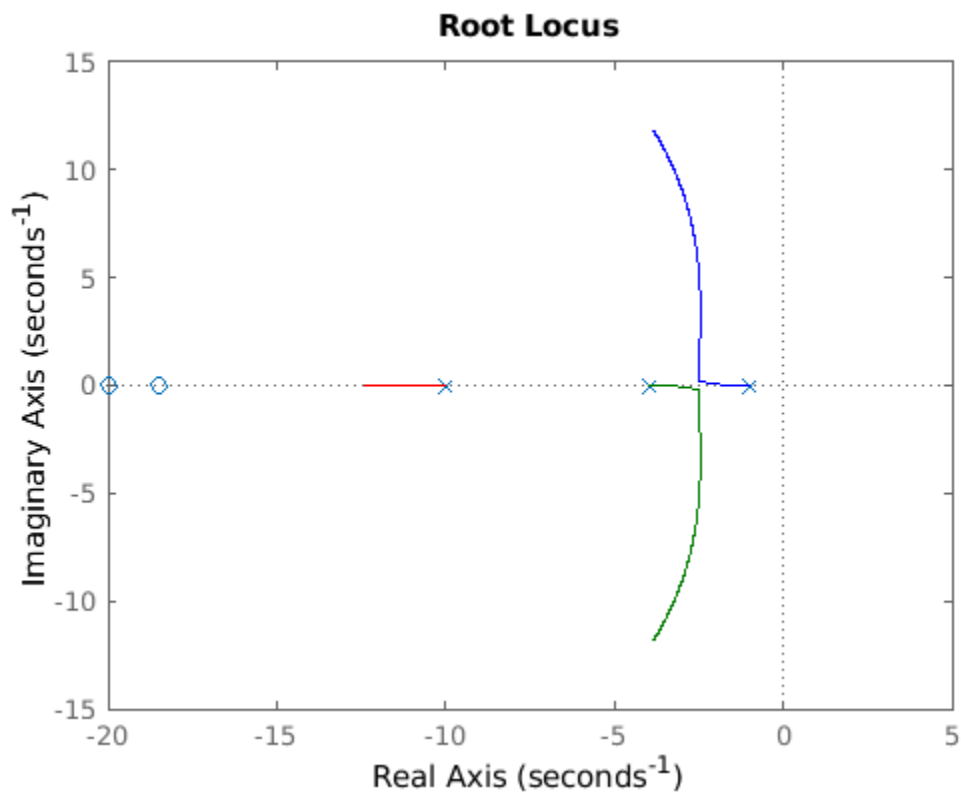   *0.3443*

zc =

```
    -18.4704


Gc =

  (s+18.47)

Continuous-time zero/pole/gain model.


K2 =

    0.1020
```

Root Locus

Simulation

```
G_cl = feedback(K2 * Gc * K1 * G, 1);
[y, t] = step(G_cl);
plot(t, y)

stepinfo(y, t)

pole(G_cl)
```
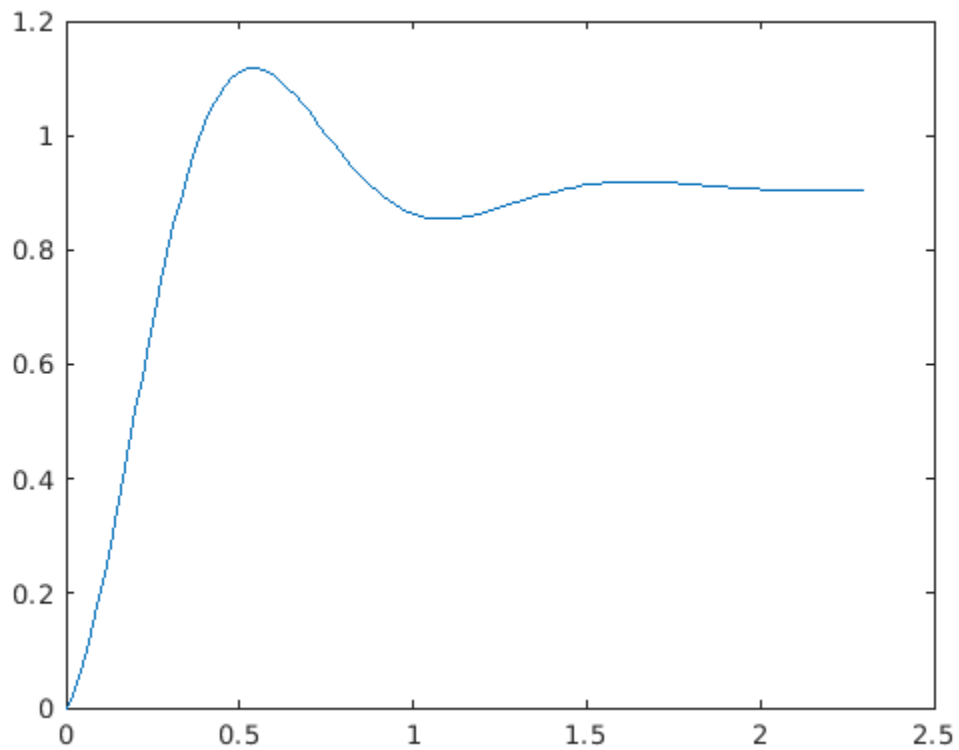
```
ans =

  struct with fields:

         RiseTime: 0.2440
    TransientTime: 1.3168
     SettlingTime: 1.3168
      SettlingMin: 0.8432
      SettlingMax: 1.1174
        Overshoot: 23.6152
       Undershoot: 0
             Peak: 1.1174
         PeakTime: 0.5477


ans =

  -2.5223 + 5.7039i
  -2.5223 - 5.7039i
 -11.0061 + 0.0000i
```


Published with MATLAB® R2021b