EJERCICIOS ENTREGABLES PRÁCTICA 2-3

Ejercicio 1 (2 puntos). Funciones de transferencia en MATLAB.

Se tiene la función de transferencia G (s) = $\frac{\alpha}{s^2 + s + \beta}$. Se pide encontrar, utilizando comandos de control de flujo (for, while, etc.) y tf/zpk, los valores de α y β que conduzcan a un sistema sobreamortiguado (con dos polos con parte real pura y diferente) aproximable a uno de primer orden con ganancia estática unitaria. Razone la respuesta.

```
alpha = 1; % Ganancia unitaria
for beta=-1:0.001:1
    if beta ~= 0
        G=tf([alpha], [1 1 beta]);
        chi = 1/(2*sqrt(beta)); % Calculamos chi
        if chi > 1 % Es sobreamortiguada
           chi
           s1 = -chi*sqrt(beta) + sqrt(beta)*sqrt(chi*chi - 1)
           s2 = -chi*sqrt(beta) - sqrt(beta)*sqrt(chi*chi - 1)
           G
           % Descartamos s2
           P = zpk([],[s1],alpha)
        end
    end
end
```

```
chi = 15.8114
s1 = -0.0010
s2 = -0.9990
G =

        1
  ---------------
  s^2 + s + 0.001

Continuous-time transfer function.
Model Properties
P =

       1
  ------------
  (s+0.001001)

Continuous-time zero/pole/gain model.
Model Properties
chi = 11.1803
s1 = -0.0020
s2 = -0.9980
G =

        1
  ---------------
  s^2 + s + 0.002
```

```
Continuous-time transfer function.
Model Properties
P =

       1
  ------------
  (s+0.002004)

Continuous-time zero/pole/gain model.
Model Properties
chi = 9.1287
s1 = -0.0030
s2 = -0.9970
G =

         1
  ---------------
  s^2 + s + 0.003

Continuous-time transfer function.
Model Properties
P =

       1
  ------------
  (s+0.003009)

Continuous-time zero/pole/gain model.
Model Properties
chi = 7.9057
s1 = -0.0040
s2 = -0.9960
G =

         1
  ---------------
  s^2 + s + 0.004

Continuous-time transfer function.
Model Properties
P =

       1
  ------------
  (s+0.004016)

Continuous-time zero/pole/gain model.
Model Properties
chi = 7.0711
s1 = -0.0050
s2 = -0.9950
G =

         1
  ---------------
  s^2 + s + 0.005

Continuous-time transfer function.
Model Properties
P =

       1
  ------------
  (s+0.005025)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 6.4550
s1 = -0.0060
s2 = -0.9940
G =

        1
  ---------------
  s^2 + s + 0.006

Continuous-time transfer function.
Model Properties
P =

       1
  ------------
  (s+0.006036)

Continuous-time zero/pole/gain model.
Model Properties
chi = 5.9761
s1 = -0.0070
s2 = -0.9930
G =

        1
  ---------------
  s^2 + s + 0.007

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.00705)

Continuous-time zero/pole/gain model.
Model Properties
chi = 5.5902
s1 = -0.0081
s2 = -0.9919
G =

        1
  ---------------
  s^2 + s + 0.008

Continuous-time transfer function.
Model Properties
P =

       1
  ------------
  (s+0.008065)

Continuous-time zero/pole/gain model.
Model Properties
chi = 5.2705
s1 = -0.0091
s2 = -0.9909
```

```
G =

        1
  ---------------
  s^2 + s + 0.009

Continuous-time transfer function.
Model Properties
P =

       1
  ------------
  (s+0.009082)

Continuous-time zero/pole/gain model.
Model Properties
chi = 5.0000
s1 = -0.0101
s2 = -0.9899
G =

        1
  --------------
  s^2 + s + 0.01

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.0101)

Continuous-time zero/pole/gain model.
Model Properties
chi = 4.7673
s1 = -0.0111
s2 = -0.9889
G =

        1
  ---------------
  s^2 + s + 0.011

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.01112)

Continuous-time zero/pole/gain model.
Model Properties
chi = 4.5644
s1 = -0.0121
s2 = -0.9879
G =

        1
  ---------------
  s^2 + s + 0.012
```

```
Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.01215)

Continuous-time zero/pole/gain model.
Model Properties
chi = 4.3853
s1 = -0.0132
s2 = -0.9868
G =

         1
  ---------------
  s^2 + s + 0.013

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.01317)

Continuous-time zero/pole/gain model.
Model Properties
chi = 4.2258
s1 = -0.0142
s2 = -0.9858
G =

         1
  ---------------
  s^2 + s + 0.014

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.0142)

Continuous-time zero/pole/gain model.
Model Properties
chi = 4.0825
s1 = -0.0152
s2 = -0.9848
G =

         1
  ---------------
  s^2 + s + 0.015

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.01523)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 3.9528
s1 = -0.0163
s2 = -0.9837
G =

        1
  ---------------
  s^2 + s + 0.016

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.01626)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.8348
s1 = -0.0173
s2 = -0.9827
G =

        1
  ---------------
  s^2 + s + 0.017

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.0173)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.7268
s1 = -0.0183
s2 = -0.9817
G =

        1
  ---------------
  s^2 + s + 0.018

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.01834)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.6274
s1 = -0.0194
s2 = -0.9806
```

```
G =

        1
  ---------------
  s^2 + s + 0.019

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.01938)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.5355
s1 = -0.0204
s2 = -0.9796
G =

        1
  --------------
  s^2 + s + 0.02

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02042)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.4503
s1 = -0.0215
s2 = -0.9785
G =

        1
  ---------------
  s^2 + s + 0.021

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02146)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.3710
s1 = -0.0225
s2 = -0.9775
G =

        1
  ---------------
  s^2 + s + 0.022
```

```
Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02251)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.2969
s1 = -0.0236
s2 = -0.9764
G =

         1
  ---------------
  s^2 + s + 0.023

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02355)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.2275
s1 = -0.0246
s2 = -0.9754
G =

         1
  ---------------
  s^2 + s + 0.024

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02461)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.1623
s1 = -0.0257
s2 = -0.9743
G =

         1
  ---------------
  s^2 + s + 0.025

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02566)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 3.1009
s1 = -0.0267
s2 = -0.9733
G =

        1
  ---------------
  s^2 + s + 0.026

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02671)

Continuous-time zero/pole/gain model.
Model Properties
chi = 3.0429
s1 = -0.0278
s2 = -0.9722
G =

        1
  ---------------
  s^2 + s + 0.027

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02777)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.9881
s1 = -0.0288
s2 = -0.9712
G =

        1
  ---------------
  s^2 + s + 0.028

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02883)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.9361
s1 = -0.0299
s2 = -0.9701
```

```
G =

        1
  ---------------
  s^2 + s + 0.029

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.02989)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.8868
s1 = -0.0310
s2 = -0.9690
G =

        1
  --------------
  s^2 + s + 0.03

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.03096)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.8398
s1 = -0.0320
s2 = -0.9680
G =

        1
  ---------------
  s^2 + s + 0.031

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.03203)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.7951
s1 = -0.0331
s2 = -0.9669
G =

        1
  ---------------
  s^2 + s + 0.032
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.0331)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.7524
s1 = -0.0342
s2 = -0.9658
G =

        1
  ---------------
  s^2 + s + 0.033

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.03417)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.7116
s1 = -0.0352
s2 = -0.9648
G =

        1
  ---------------
  s^2 + s + 0.034

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.03524)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.6726
s1 = -0.0363
s2 = -0.9637
G =

        1
  ---------------
  s^2 + s + 0.035

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.03632)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 2.6352
s1 = -0.0374
s2 = -0.9626
G =

        1
  ---------------
  s^2 + s + 0.036

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.0374)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.5994
s1 = -0.0385
s2 = -0.9615
G =

        1
  ---------------
  s^2 + s + 0.037

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.03848)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.5649
s1 = -0.0396
s2 = -0.9604
G =

        1
  ---------------
  s^2 + s + 0.038

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.03957)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.5318
s1 = -0.0407
s2 = -0.9593
```

```
G =

        1
  ---------------
  s^2 + s + 0.039

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04065)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.5000
s1 = -0.0417
s2 = -0.9583
G =

        1
  --------------
  s^2 + s + 0.04

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04174)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.4693
s1 = -0.0428
s2 = -0.9572
G =

        1
  ---------------
  s^2 + s + 0.041

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04283)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.4398
s1 = -0.0439
s2 = -0.9561
G =

        1
  ---------------
  s^2 + s + 0.042
```

```
Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04393)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.4112
s1 = -0.0450
s2 = -0.9550
G =

         1
  ---------------
  s^2 + s + 0.043

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04503)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.3837
s1 = -0.0461
s2 = -0.9539
G =

         1
  ---------------
  s^2 + s + 0.044

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04613)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.3570
s1 = -0.0472
s2 = -0.9528
G =

         1
  ---------------
  s^2 + s + 0.045

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04723)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 2.3313
s1 = -0.0483
s2 = -0.9517
G =

        1
  ---------------
  s^2 + s + 0.046

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04834)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.3063
s1 = -0.0494
s2 = -0.9506
G =

        1
  ---------------
  s^2 + s + 0.047

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.04944)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.2822
s1 = -0.0506
s2 = -0.9494
G =

        1
  ---------------
  s^2 + s + 0.048

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05056)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.2588
s1 = -0.0517
s2 = -0.9483
```

```
G =

        1
  ---------------
  s^2 + s + 0.049

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05167)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.2361
s1 = -0.0528
s2 = -0.9472
G =

        1
  --------------
  s^2 + s + 0.05

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05279)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.2140
s1 = -0.0539
s2 = -0.9461
G =

        1
  ---------------
  s^2 + s + 0.051

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05391)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.1926
s1 = -0.0550
s2 = -0.9450
G =

        1
  ---------------
  s^2 + s + 0.052
```

```
Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05503)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.1719
s1 = -0.0562
s2 = -0.9438
G =

         1
  ---------------
  s^2 + s + 0.053

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05615)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.1517
s1 = -0.0573
s2 = -0.9427
G =

         1
  ---------------
  s^2 + s + 0.054

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05728)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.1320
s1 = -0.0584
s2 = -0.9416
G =

         1
  ---------------
  s^2 + s + 0.055

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05841)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 2.1129
s1 = -0.0595
s2 = -0.9405
G =

        1
  ---------------
  s^2 + s + 0.056

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.05955)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.0943
s1 = -0.0607
s2 = -0.9393
G =

        1
  ---------------
  s^2 + s + 0.057

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06068)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.0761
s1 = -0.0618
s2 = -0.9382
G =

        1
  ---------------
  s^2 + s + 0.058

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06182)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.0585
s1 = -0.0630
s2 = -0.9370
```

```
G =

        1
  ---------------
  s^2 + s + 0.059

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06296)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.0412
s1 = -0.0641
s2 = -0.9359
G =

        1
  --------------
  s^2 + s + 0.06

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06411)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.0244
s1 = -0.0653
s2 = -0.9347
G =

        1
  ---------------
  s^2 + s + 0.061

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06526)

Continuous-time zero/pole/gain model.
Model Properties
chi = 2.0080
s1 = -0.0664
s2 = -0.9336
G =

        1
  ---------------
  s^2 + s + 0.062
```

```
Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06641)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.9920
s1 = -0.0676
s2 = -0.9324
G =

         1
  ---------------
  s^2 + s + 0.063

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06757)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.9764
s1 = -0.0687
s2 = -0.9313
G =

         1
  ---------------
  s^2 + s + 0.064

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06872)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.9612
s1 = -0.0699
s2 = -0.9301
G =

         1
  ---------------
  s^2 + s + 0.065

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.06988)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.9462
s1 = -0.0710
s2 = -0.9290
G =

        1
  ---------------
  s^2 + s + 0.066

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.07105)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.9317
s1 = -0.0722
s2 = -0.9278
G =

        1
  ---------------
  s^2 + s + 0.067

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.07222)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.9174
s1 = -0.0734
s2 = -0.9266
G =

        1
  ---------------
  s^2 + s + 0.068

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.07339)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.9035
s1 = -0.0746
s2 = -0.9254
```

```
G =

        1
  ---------------
  s^2 + s + 0.069

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.07456)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.8898
s1 = -0.0757
s2 = -0.9243
G =

        1
  --------------
  s^2 + s + 0.07

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.07574)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.8765
s1 = -0.0769
s2 = -0.9231
G =

        1
  ---------------
  s^2 + s + 0.071

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.07692)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.8634
s1 = -0.0781
s2 = -0.9219
G =

        1
  ---------------
  s^2 + s + 0.072
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.0781)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.8506
s1 = -0.0793
s2 = -0.9207
G =

        1
  ---------------
  s^2 + s + 0.073

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.07929)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.8380
s1 = -0.0805
s2 = -0.9195
G =

        1
  ---------------
  s^2 + s + 0.074

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.08048)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.8257
s1 = -0.0817
s2 = -0.9183
G =

        1
  ---------------
  s^2 + s + 0.075

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.08167)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.8137
s1 = -0.0829
s2 = -0.9171
G =

        1
  ---------------
  s^2 + s + 0.076

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.08287)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.8019
s1 = -0.0841
s2 = -0.9159
G =

        1
  ---------------
  s^2 + s + 0.077

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.08407)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7903
s1 = -0.0853
s2 = -0.9147
G =

        1
  ---------------
  s^2 + s + 0.078

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.08527)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7789
s1 = -0.0865
s2 = -0.9135
```

```
G =

        1
  ---------------
  s^2 + s + 0.079

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.08648)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7678
s1 = -0.0877
s2 = -0.9123
G =

        1
  --------------
  s^2 + s + 0.08

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.08769)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7568
s1 = -0.0889
s2 = -0.9111
G =

        1
  ---------------
  s^2 + s + 0.081

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.0889)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7461
s1 = -0.0901
s2 = -0.9099
G =

        1
  ---------------
  s^2 + s + 0.082
```

```
Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.09012)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7355
s1 = -0.0913
s2 = -0.9087
G =

         1
  ---------------
  s^2 + s + 0.083

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.09134)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7252
s1 = -0.0926
s2 = -0.9074
G =

         1
  ---------------
  s^2 + s + 0.084

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.09257)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7150
s1 = -0.0938
s2 = -0.9062
G =

         1
  ---------------
  s^2 + s + 0.085

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.0938)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.7050
s1 = -0.0950
s2 = -0.9050
G =

        1
  ---------------
  s^2 + s + 0.086

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.09503)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6952
s1 = -0.0963
s2 = -0.9037
G =

        1
  ---------------
  s^2 + s + 0.087

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.09627)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6855
s1 = -0.0975
s2 = -0.9025
G =

        1
  ---------------
  s^2 + s + 0.088

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.09751)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6760
s1 = -0.0988
s2 = -0.9012
```

```
G =

        1
  ---------------
  s^2 + s + 0.089

Continuous-time transfer function.
Model Properties
P =

       1
  -----------
  (s+0.09875)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6667
s1 = -0.1000
s2 = -0.9000
G =

        1
  --------------
  s^2 + s + 0.09

Continuous-time transfer function.
Model Properties
P =

     1
  -------
  (s+0.1)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6575
s1 = -0.1013
s2 = -0.8987
G =

        1
  ---------------
  s^2 + s + 0.091

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1013)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6485
s1 = -0.1025
s2 = -0.8975
G =

        1
  ---------------
  s^2 + s + 0.092
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1025)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6396
s1 = -0.1038
s2 = -0.8962
G =

        1
  ---------------
  s^2 + s + 0.093

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1038)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6308
s1 = -0.1050
s2 = -0.8950
G =

        1
  ---------------
  s^2 + s + 0.094

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.105)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6222
s1 = -0.1063
s2 = -0.8937
G =

        1
  ---------------
  s^2 + s + 0.095

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1063)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6137
s1 = -0.1076
s2 = -0.8924
G =

        1
  ---------------
  s^2 + s + 0.096

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1076)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.6054
s1 = -0.1088
s2 = -0.8912
G =

        1
  ---------------
  s^2 + s + 0.097

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1088)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5972
s1 = -0.1101
s2 = -0.8899
G =

        1
  ---------------
  s^2 + s + 0.098

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1101)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5891
s1 = -0.1114
s2 = -0.8886
```

```
G =

        1
  ---------------
  s^2 + s + 0.099

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1114)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5811
s1 = -0.1127
s2 = -0.8873
G =

       1
  -------------
  s^2 + s + 0.1

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1127)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5733
s1 = -0.1140
s2 = -0.8860
G =

        1
  ---------------
  s^2 + s + 0.101

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.114)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5656
s1 = -0.1153
s2 = -0.8847
G =

        1
  ---------------
  s^2 + s + 0.102
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1153)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5579
s1 = -0.1166
s2 = -0.8834
G =

        1
  ---------------
  s^2 + s + 0.103

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1166)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5504
s1 = -0.1179
s2 = -0.8821
G =

        1
  ---------------
  s^2 + s + 0.104

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1179)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5430
s1 = -0.1192
s2 = -0.8808
G =

        1
  ---------------
  s^2 + s + 0.105

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1192)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5357
s1 = -0.1205
s2 = -0.8795
G =

        1
  ---------------
  s^2 + s + 0.106

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1205)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5285
s1 = -0.1218
s2 = -0.8782
G =

        1
  ---------------
  s^2 + s + 0.107

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1218)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5215
s1 = -0.1232
s2 = -0.8768
G =

        1
  ---------------
  s^2 + s + 0.108

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1232)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5145
s1 = -0.1245
s2 = -0.8755
```

```
G =

        1
  ---------------
  s^2 + s + 0.109

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1245)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5076
s1 = -0.1258
s2 = -0.8742
G =

       1
  --------------
  s^2 + s + 0.11

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1258)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.5008
s1 = -0.1272
s2 = -0.8728
G =

        1
  ---------------
  s^2 + s + 0.111

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1272)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4940
s1 = -0.1285
s2 = -0.8715
G =

        1
  ---------------
  s^2 + s + 0.112
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1285)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4874
s1 = -0.1299
s2 = -0.8701
G =

        1
  ---------------
  s^2 + s + 0.113

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1299)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4809
s1 = -0.1312
s2 = -0.8688
G =

        1
  ---------------
  s^2 + s + 0.114

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1312)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4744
s1 = -0.1326
s2 = -0.8674
G =

        1
  ---------------
  s^2 + s + 0.115

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1326)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4681
s1 = -0.1339
s2 = -0.8661
G =

        1
  ---------------
  s^2 + s + 0.116

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1339)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4618
s1 = -0.1353
s2 = -0.8647
G =

        1
  ---------------
  s^2 + s + 0.117

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1353)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4556
s1 = -0.1367
s2 = -0.8633
G =

        1
  ---------------
  s^2 + s + 0.118

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1367)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4494
s1 = -0.1381
s2 = -0.8619
```

```
G =

        1
  ---------------
  s^2 + s + 0.119

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1381)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4434
s1 = -0.1394
s2 = -0.8606
G =

       1
  --------------
  s^2 + s + 0.12

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1394)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4374
s1 = -0.1408
s2 = -0.8592
G =

        1
  ---------------
  s^2 + s + 0.121

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1408)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4315
s1 = -0.1422
s2 = -0.8578
G =

        1
  ---------------
  s^2 + s + 0.122
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1422)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4257
s1 = -0.1436
s2 = -0.8564
G =

        1
  ---------------
  s^2 + s + 0.123

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1436)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4199
s1 = -0.1450
s2 = -0.8550
G =

        1
  ---------------
  s^2 + s + 0.124

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.145)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4142
s1 = -0.1464
s2 = -0.8536
G =

        1
  ---------------
  s^2 + s + 0.125

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1464)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4086
s1 = -0.1479
s2 = -0.8521
G =

        1
  ---------------
  s^2 + s + 0.126

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1479)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.4030
s1 = -0.1493
s2 = -0.8507
G =

        1
  ---------------
  s^2 + s + 0.127

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1493)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3975
s1 = -0.1507
s2 = -0.8493
G =

        1
  ---------------
  s^2 + s + 0.128

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1507)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3921
s1 = -0.1521
s2 = -0.8479
```

```
G =

        1
  ---------------
  s^2 + s + 0.129

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1521)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3868
s1 = -0.1536
s2 = -0.8464
G =

       1
  --------------
  s^2 + s + 0.13

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1536)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3814
s1 = -0.1550
s2 = -0.8450
G =

        1
  ---------------
  s^2 + s + 0.131

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.155)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3762
s1 = -0.1565
s2 = -0.8435
G =

        1
  ---------------
  s^2 + s + 0.132
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1565)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3710
s1 = -0.1579
s2 = -0.8421
G =

        1
  ---------------
  s^2 + s + 0.133

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1579)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3659
s1 = -0.1594
s2 = -0.8406
G =

        1
  ---------------
  s^2 + s + 0.134

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1594)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3608
s1 = -0.1609
s2 = -0.8391
G =

        1
  ---------------
  s^2 + s + 0.135

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1609)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3558
s1 = -0.1624
s2 = -0.8376
G =

        1
  ---------------
  s^2 + s + 0.136

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1624)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3509
s1 = -0.1638
s2 = -0.8362
G =

        1
  ---------------
  s^2 + s + 0.137

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1638)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3460
s1 = -0.1653
s2 = -0.8347
G =

        1
  ---------------
  s^2 + s + 0.138

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1653)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3411
s1 = -0.1668
s2 = -0.8332
```

```
G =

        1
  ---------------
  s^2 + s + 0.139

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1668)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3363
s1 = -0.1683
s2 = -0.8317
G =

       1
  --------------
  s^2 + s + 0.14

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1683)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3316
s1 = -0.1698
s2 = -0.8302
G =

        1
  ---------------
  s^2 + s + 0.141

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1698)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3269
s1 = -0.1714
s2 = -0.8286
G =

        1
  ---------------
  s^2 + s + 0.142
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1714)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3222
s1 = -0.1729
s2 = -0.8271
G =

        1
  ---------------
  s^2 + s + 0.143

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1729)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3176
s1 = -0.1744
s2 = -0.8256
G =

        1
  ---------------
  s^2 + s + 0.144

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1744)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3131
s1 = -0.1760
s2 = -0.8240
G =

        1
  ---------------
  s^2 + s + 0.145

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.176)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3086
s1 = -0.1775
s2 = -0.8225
G =

        1
  ---------------
  s^2 + s + 0.146

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1775)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.3041
s1 = -0.1791
s2 = -0.8209
G =

        1
  ---------------
  s^2 + s + 0.147

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1791)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2997
s1 = -0.1806
s2 = -0.8194
G =

        1
  ---------------
  s^2 + s + 0.148

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1806)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2953
s1 = -0.1822
s2 = -0.8178
```

```
G =

        1
  ---------------
  s^2 + s + 0.149

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1822)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2910
s1 = -0.1838
s2 = -0.8162
G =

       1
  --------------
  s^2 + s + 0.15

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1838)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2867
s1 = -0.1854
s2 = -0.8146
G =

        1
  ---------------
  s^2 + s + 0.151

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1854)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2825
s1 = -0.1870
s2 = -0.8130
G =

        1
  ---------------
  s^2 + s + 0.152
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.187)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2783
s1 = -0.1886
s2 = -0.8114
G =

         1
  ---------------
  s^2 + s + 0.153

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1886)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2741
s1 = -0.1902
s2 = -0.8098
G =

         1
  ---------------
  s^2 + s + 0.154

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1902)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2700
s1 = -0.1918
s2 = -0.8082
G =

         1
  ---------------
  s^2 + s + 0.155

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1918)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2659
s1 = -0.1934
s2 = -0.8066
G =

        1
  ---------------
  s^2 + s + 0.156

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1934)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2619
s1 = -0.1950
s2 = -0.8050
G =

        1
  ---------------
  s^2 + s + 0.157

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.195)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2579
s1 = -0.1967
s2 = -0.8033
G =

        1
  ---------------
  s^2 + s + 0.158

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1967)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2539
s1 = -0.1983
s2 = -0.8017
```

```
G =

        1
  ---------------
  s^2 + s + 0.159

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.1983)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2500
s1 = -0.2000
s2 = -0.8000
G =

        1
  --------------
  s^2 + s + 0.16

Continuous-time transfer function.
Model Properties
P =

     1
  -------
  (s+0.2)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2461
s1 = -0.2017
s2 = -0.7983
G =

        1
  ---------------
  s^2 + s + 0.161

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2017)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2423
s1 = -0.2034
s2 = -0.7966
G =

        1
  ---------------
  s^2 + s + 0.162
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2034)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2384
s1 = -0.2050
s2 = -0.7950
G =

        1
  ---------------
  s^2 + s + 0.163

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.205)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2347
s1 = -0.2067
s2 = -0.7933
G =

        1
  ---------------
  s^2 + s + 0.164

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2067)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2309
s1 = -0.2085
s2 = -0.7915
G =

        1
  ---------------
  s^2 + s + 0.165

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2085)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2272
s1 = -0.2102
s2 = -0.7898
G =

        1
  ---------------
  s^2 + s + 0.166

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2102)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2235
s1 = -0.2119
s2 = -0.7881
G =

        1
  ---------------
  s^2 + s + 0.167

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2119)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2199
s1 = -0.2136
s2 = -0.7864
G =

        1
  ---------------
  s^2 + s + 0.168

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2136)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2163
s1 = -0.2154
s2 = -0.7846
```

```
G =

        1
  ---------------
  s^2 + s + 0.169

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2154)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2127
s1 = -0.2172
s2 = -0.7828
G =

       1
  --------------
  s^2 + s + 0.17

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2172)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2091
s1 = -0.2189
s2 = -0.7811
G =

        1
  ---------------
  s^2 + s + 0.171

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2189)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2056
s1 = -0.2207
s2 = -0.7793
G =

        1
  ---------------
  s^2 + s + 0.172
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2207)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.2021
s1 = -0.2225
s2 = -0.7775
G =

        1
  ---------------
  s^2 + s + 0.173

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2225)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1987
s1 = -0.2243
s2 = -0.7757
G =

        1
  ---------------
  s^2 + s + 0.174

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2243)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1952
s1 = -0.2261
s2 = -0.7739
G =

        1
  ---------------
  s^2 + s + 0.175

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2261)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1918
s1 = -0.2280
s2 = -0.7720
G =

        1
  ---------------
  s^2 + s + 0.176

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.228)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1885
s1 = -0.2298
s2 = -0.7702
G =

        1
  ---------------
  s^2 + s + 0.177

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2298)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1851
s1 = -0.2317
s2 = -0.7683
G =

        1
  ---------------
  s^2 + s + 0.178

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2317)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1818
s1 = -0.2335
s2 = -0.7665
```

```
G =

        1
  ---------------
  s^2 + s + 0.179

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2335)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1785
s1 = -0.2354
s2 = -0.7646
G =

       1
  --------------
  s^2 + s + 0.18

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2354)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1753
s1 = -0.2373
s2 = -0.7627
G =

        1
  ---------------
  s^2 + s + 0.181

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2373)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1720
s1 = -0.2392
s2 = -0.7608
G =

        1
  ---------------
  s^2 + s + 0.182
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2392)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1688
s1 = -0.2412
s2 = -0.7588
G =

        1
  ---------------
  s^2 + s + 0.183

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2412)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1656
s1 = -0.2431
s2 = -0.7569
G =

        1
  ---------------
  s^2 + s + 0.184

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2431)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1625
s1 = -0.2450
s2 = -0.7550
G =

        1
  ---------------
  s^2 + s + 0.185

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.245)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1593
s1 = -0.2470
s2 = -0.7530
G =

        1
  ---------------
  s^2 + s + 0.186

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.247)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1562
s1 = -0.2490
s2 = -0.7510
G =

        1
  ---------------
  s^2 + s + 0.187

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.249)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1532
s1 = -0.2510
s2 = -0.7490
G =

        1
  ---------------
  s^2 + s + 0.188

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.251)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1501
s1 = -0.2530
s2 = -0.7470
```

```
G =

        1
  ---------------
  s^2 + s + 0.189

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.253)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1471
s1 = -0.2551
s2 = -0.7449
G =

       1
  --------------
  s^2 + s + 0.19

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2551)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1441
s1 = -0.2571
s2 = -0.7429
G =

        1
  ---------------
  s^2 + s + 0.191

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2571)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1411
s1 = -0.2592
s2 = -0.7408
G =

        1
  ---------------
  s^2 + s + 0.192
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2592)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1381
s1 = -0.2613
s2 = -0.7387
G =

        1
  ---------------
  s^2 + s + 0.193

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2613)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1352
s1 = -0.2634
s2 = -0.7366
G =

        1
  ---------------
  s^2 + s + 0.194

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2634)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1323
s1 = -0.2655
s2 = -0.7345
G =

        1
  ---------------
  s^2 + s + 0.195

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2655)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1294
s1 = -0.2676
s2 = -0.7324
G =

        1
  ---------------
  s^2 + s + 0.196

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2676)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1265
s1 = -0.2698
s2 = -0.7302
G =

        1
  ---------------
  s^2 + s + 0.197

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2698)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1237
s1 = -0.2720
s2 = -0.7280
G =

        1
  ---------------
  s^2 + s + 0.198

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.272)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1208
s1 = -0.2742
s2 = -0.7258
```

```
G =

        1
  ---------------
  s^2 + s + 0.199

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2742)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1180
s1 = -0.2764
s2 = -0.7236
G =

       1
  -------------
  s^2 + s + 0.2

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2764)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1152
s1 = -0.2786
s2 = -0.7214
G =

        1
  ---------------
  s^2 + s + 0.201

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2786)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1125
s1 = -0.2809
s2 = -0.7191
G =

        1
  ---------------
  s^2 + s + 0.202
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2809)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1097
s1 = -0.2832
s2 = -0.7168
G =

        1
  ---------------
  s^2 + s + 0.203

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2832)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1070
s1 = -0.2855
s2 = -0.7145
G =

        1
  ---------------
  s^2 + s + 0.204

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2855)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1043
s1 = -0.2879
s2 = -0.7121
G =

        1
  ---------------
  s^2 + s + 0.205

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2879)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.1016
s1 = -0.2902
s2 = -0.7098
G =

        1
  ---------------
  s^2 + s + 0.206

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2902)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0990
s1 = -0.2926
s2 = -0.7074
G =

        1
  ---------------
  s^2 + s + 0.207

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2926)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0963
s1 = -0.2951
s2 = -0.7049
G =

        1
  ---------------
  s^2 + s + 0.208

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2951)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0937
s1 = -0.2975
s2 = -0.7025
```

```
G =

        1
  ---------------
  s^2 + s + 0.209

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.2975)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0911
s1 = -0.3000
s2 = -0.7000
G =

        1
  --------------
  s^2 + s + 0.21

Continuous-time transfer function.
Model Properties
P =

     1
  -------
  (s+0.3)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0885
s1 = -0.3025
s2 = -0.6975
G =

        1
  ---------------
  s^2 + s + 0.211

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3025)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0859
s1 = -0.3051
s2 = -0.6949
G =

        1
  ---------------
  s^2 + s + 0.212
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3051)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0834
s1 = -0.3076
s2 = -0.6924
G =

        1
  ---------------
  s^2 + s + 0.213

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3076)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0808
s1 = -0.3103
s2 = -0.6897
G =

        1
  ---------------
  s^2 + s + 0.214

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3103)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0783
s1 = -0.3129
s2 = -0.6871
G =

        1
  ---------------
  s^2 + s + 0.215

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3129)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0758
s1 = -0.3156
s2 = -0.6844
G =

        1
  ---------------
  s^2 + s + 0.216

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3156)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0733
s1 = -0.3183
s2 = -0.6817
G =

        1
  ---------------
  s^2 + s + 0.217

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3183)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0709
s1 = -0.3211
s2 = -0.6789
G =

        1
  ---------------
  s^2 + s + 0.218

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3211)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0684
s1 = -0.3239
s2 = -0.6761
```

```
G =

        1
  ---------------
  s^2 + s + 0.219

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3239)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0660
s1 = -0.3268
s2 = -0.6732
G =

       1
  --------------
  s^2 + s + 0.22

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3268)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0636
s1 = -0.3297
s2 = -0.6703
G =

        1
  ---------------
  s^2 + s + 0.221

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3297)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0612
s1 = -0.3327
s2 = -0.6673
G =

        1
  ---------------
  s^2 + s + 0.222
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3327)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0588
s1 = -0.3357
s2 = -0.6643
G =

        1
  ---------------
  s^2 + s + 0.223

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3357)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0564
s1 = -0.3388
s2 = -0.6612
G =

        1
  ---------------
  s^2 + s + 0.224

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3388)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0541
s1 = -0.3419
s2 = -0.6581
G =

        1
  ---------------
  s^2 + s + 0.225

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3419)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0518
s1 = -0.3451
s2 = -0.6549
G =

        1
  ---------------
  s^2 + s + 0.226

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3451)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0494
s1 = -0.3483
s2 = -0.6517
G =

        1
  ---------------
  s^2 + s + 0.227

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3483)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0471
s1 = -0.3517
s2 = -0.6483
G =

        1
  ---------------
  s^2 + s + 0.228

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3517)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0448
s1 = -0.3551
s2 = -0.6449
```

```
G =

        1
  ---------------
  s^2 + s + 0.229

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3551)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0426
s1 = -0.3586
s2 = -0.6414
G =

       1
  --------------
  s^2 + s + 0.23

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3586)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0403
s1 = -0.3622
s2 = -0.6378
G =

        1
  ---------------
  s^2 + s + 0.231

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3622)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0381
s1 = -0.3658
s2 = -0.6342
G =

        1
  ---------------
  s^2 + s + 0.232
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3658)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0358
s1 = -0.3696
s2 = -0.6304
G =

        1
  ---------------
  s^2 + s + 0.233

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3696)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0336
s1 = -0.3735
s2 = -0.6265
G =

        1
  ---------------
  s^2 + s + 0.234

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3735)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0314
s1 = -0.3775
s2 = -0.6225
G =

        1
  ---------------
  s^2 + s + 0.235

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3775)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0292
s1 = -0.3817
s2 = -0.6183
G =

        1
  ---------------
  s^2 + s + 0.236

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3817)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0271
s1 = -0.3860
s2 = -0.6140
G =

        1
  ---------------
  s^2 + s + 0.237

Continuous-time transfer function.
Model Properties
P =

      1
  ---------
  (s+0.386)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0249
s1 = -0.3905
s2 = -0.6095
G =

        1
  ---------------
  s^2 + s + 0.238

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3905)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0228
s1 = -0.3951
s2 = -0.6049
```

```
G =

        1
  ---------------
  s^2 + s + 0.239

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.3951)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0206
s1 = -0.4000
s2 = -0.6000
G =

       1
  --------------
  s^2 + s + 0.24

Continuous-time transfer function.
Model Properties
P =

     1
  -------
  (s+0.4)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0185
s1 = -0.4051
s2 = -0.5949
G =

        1
  ---------------
  s^2 + s + 0.241

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4051)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0164
s1 = -0.4106
s2 = -0.5894
G =

        1
  ---------------
  s^2 + s + 0.242
```

```
Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4106)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0143
s1 = -0.4163
s2 = -0.5837
G =

        1
  ---------------
  s^2 + s + 0.243

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4163)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0122
s1 = -0.4225
s2 = -0.5775
G =

        1
  ---------------
  s^2 + s + 0.244

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4225)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0102
s1 = -0.4293
s2 = -0.5707
G =

        1
  ---------------
  s^2 + s + 0.245

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4293)
```

```
Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0081
s1 = -0.4368
s2 = -0.5632
G =

        1
  ---------------
  s^2 + s + 0.246

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4368)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0061
s1 = -0.4452
s2 = -0.5548
G =

        1
  ---------------
  s^2 + s + 0.247

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4452)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0040
s1 = -0.4553
s2 = -0.5447
G =

        1
  ---------------
  s^2 + s + 0.248

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4553)

Continuous-time zero/pole/gain model.
Model Properties
chi = 1.0020
s1 = -0.4684
s2 = -0.5316
```

```
G =

        1
  ---------------
  s^2 + s + 0.249

Continuous-time transfer function.
Model Properties
P =

      1
  ----------
  (s+0.4684)

Continuous-time zero/pole/gain model.
Model Properties
```

Antes de ejecutar el código, procederemos a explicarlo:

- Alpha lo igualamos a 1, ya que para coseguir un sistema de primer orden con ganancia unitaria, necesitamos reducir el orden del sistema usando aproximacion por polos dominantes y la ganancia del sistema original sera la misma del aproximado, luego como alpha es igual a k·beta si se puede igualar a 1.
- El for lo vamos a usar para que nos pruebe distintos valores de beta, en el rango desde -1 hasta 1, y con el if nos aseguramos no crear una funcion de transferencia nula.
- Definimos usando tf la funcion de transferencia del sistema.
- A continuacion usamos if para comprobar si chi es mayor que 1, es decir que el sistema es sobreamortiguado, y si lo es mostramos el valor de chi y de los polos resultantes.
- Como cuando chi >> 1 podemos descartar el polo mas rapido s2, el sistema queda dominado por s1, es decir un sistema de primer orden con ganancia alpha que es unitaria.
- Y por ultimo, la línea de zpk nos crea el sistema de primer orden deseado.

Ahora, si lo ejecutamos:

Observamos los resultados obtenidos y podemos apreciar que los valores deseados para alpha es 1 y que cuanto mas cerac de 0 este beta mas alto sera el valor de chi, y por lo tanto mayor sera la disparidad entre los 2 polos. Luego nos vamos a quedar con beta = 0.001 ya que da el valor de chi mas alto. El sistema resultante queda:

```
alpha = 1;
beta = 0.001;

G=tf([alpha], [1 1 beta])
```

```
G =

        1
  ---------------
  s^2 + s + 0.001

Continuous-time transfer function.
Model Properties
```

```
chi = 1/(2*sqrt(beta))
```

```
chi = 15.8114
```

```
s1 = -chi*sqrt(beta) + sqrt(beta)*sqrt(chi*chi - 1)
```

```
s1 = -0.0010
```

```
s2 = -chi*sqrt(beta) - sqrt(beta)*sqrt(chi*chi - 1)
```

```
s2 = -0.9990
```

```
%Descartamos s2
P = zpk([],[s1],alpha)
```

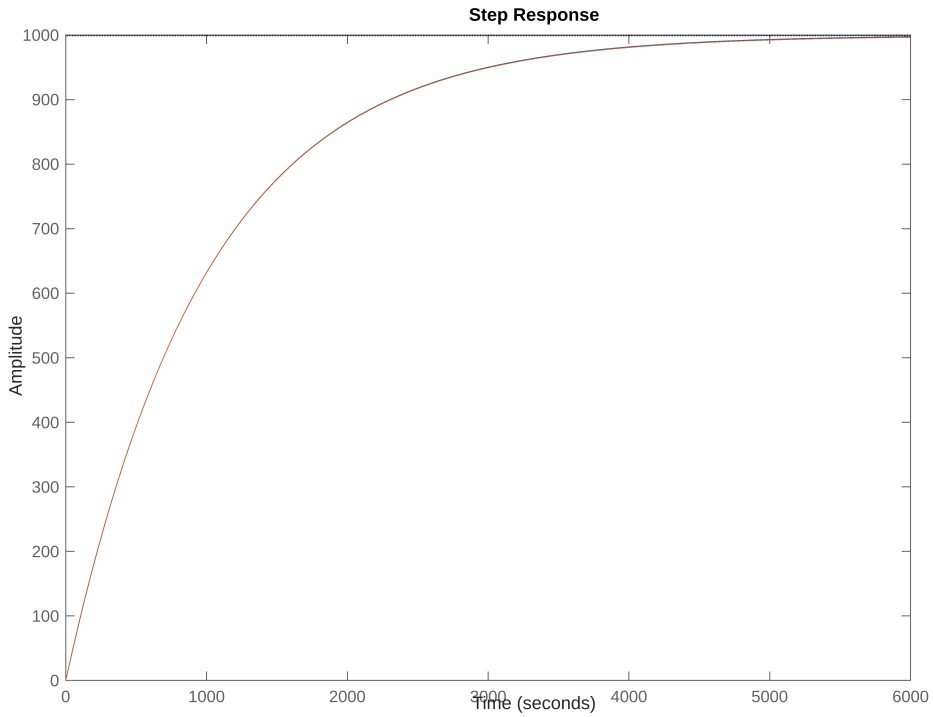
```
P =

       1
  ------------
  (s+0.001001)

Continuous-time zero/pole/gain model.
Model Properties
```

```
% Lo mostramos frente a una entrada escalon
step(G,P)
```

```
Warning: MATLAB has disabled some advanced graphics rendering features by switching to software
OpenGL. For more information, click here.
```



```
% Son muy similares
```