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Title:ControlSystemsecondorder:negative fb with different parameter values

```
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%Date:10/04/2021
%Version:1.4
```

This Document has equation for DC motor system

```
%Equation1:vi=IR+L(di/dt)+kw
%Equation2:J(dw/dt)+bw=kI
```

Math Analysis

Independent variables: T Dependent Variables:w,I Constants:L,K,R

```
%Roots:-(((RJ+bL)/JL)+-(2((R^2*J^2+b^2*L^2+2JbL)/J^2*L^2)-4((bR+k^2)/
JL))^1/2)/2
```

```
J = 0.01;
b = 0.1;
K = 1;
R = 1;
L = 0.5;
TF=tf([K/(J*L)],[1,((b/J)+(R/L)),(((K*K)+(R*b))/(L*J))]);
CF=10
sys = CF*TF
NCTF=feedback(sys,1)
subplot(4,2,1)
step(NCTF)
title("Step 1")
subplot(4,2,2)
impulse(NCTF)
title("impulse1")
S = stepinfo(NCTF)
[wn,zeta]=damp(NCTF)

J = 0.1;
b = 1;
K = 0.1;
```

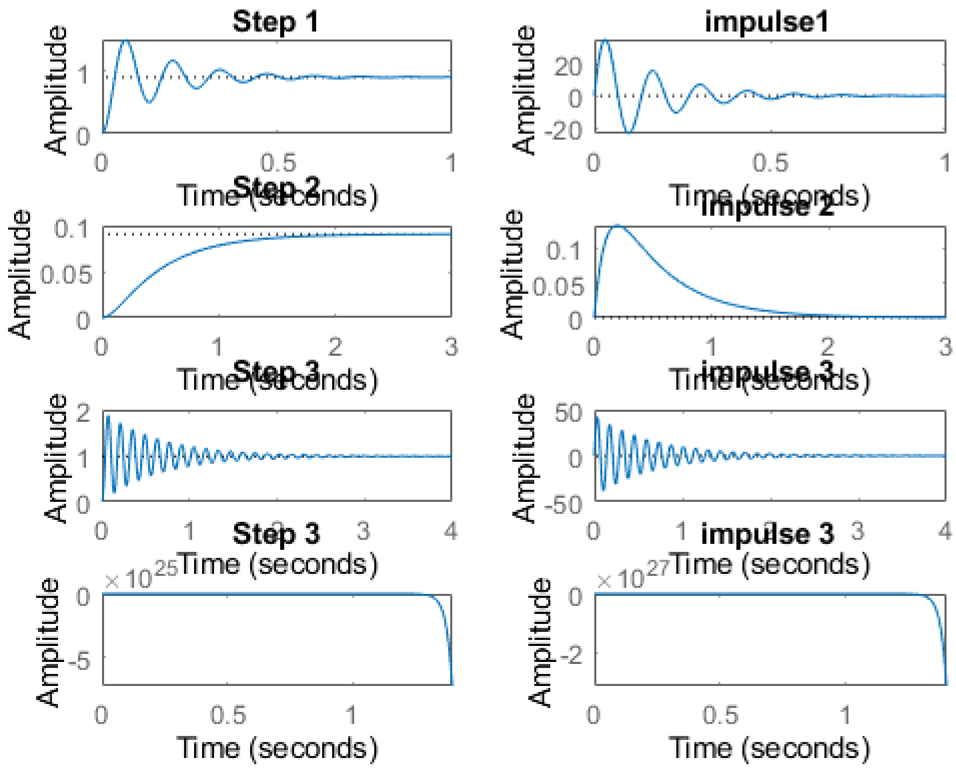
```
R = 10;
L = 5;
TF=tf([K/(J*L)],[1,((b/J)+(R/L)),(((K*K)+(R*b))/(L*J))]);
CF=10
sys = CF*TF
NCTF1=feedback(sys,1)
subplot(4,2,3)
step(NCTF1)
title("Step 2")
subplot(4,2,4)
impulse(NCTF1)
title("impulse 2")
S = stepinfo(NCTF1)
[wn,zeta]=damp(NCTF1)

J = 0.01;
b = 0.01;
K = 0.1;
R = 0.1;
L = 0.05;
TF=tf([K/(J*L)],[1,((b/J)+(R/L)),(((K*K)+(R*b))/(L*J))]);
CF=10
sys = CF*TF
NCTF2=feedback(sys,1)
subplot(4,2,5)
step(NCTF2)
title("Step 3")
subplot(4,2,6)
impulse(NCTF2)
title("impulse 3")
S = stepinfo(NCTF2)
[wn,zeta]=damp(NCTF2)



J = -0.01;
b = -0.01;
K = -0.1;
R = -0.1;
L = -0.05;
TF=tf([K/(J*L)],[1,((b/J)+(R/L)),(((K*K)+(R*b))/(L*J))]);
CF=10
sys = CF*TF
NCTF3=feedback(sys,1)
subplot(4,2,7)
step(NCTF3)
title("Step 3")
subplot(4,2,8)
impulse(NCTF3)
title("impulse 3")
S = stepinfo(NCTF3)
[wn,zeta]=damp(NCTF3)
```

```
CF =

    10


sys =

        2000
  ----------------
  s^2 + 12 s + 220

Continuous-time transfer function.


NCTF =

        2000
  -----------------
  s^2 + 12 s + 2220

Continuous-time transfer function.


S =

  struct with fields:

        RiseTime: 0.0245
    SettlingTime: 0.6206
     SettlingMin: 0.4993
     SettlingMax: 1.5026
       Overshoot: 66.7860
      Undershoot: 0
            Peak: 1.5026
        PeakTime: 0.0667


wn =

   47.1169
   47.1169


zeta =

    0.1273
    0.1273


CF =

    10
```

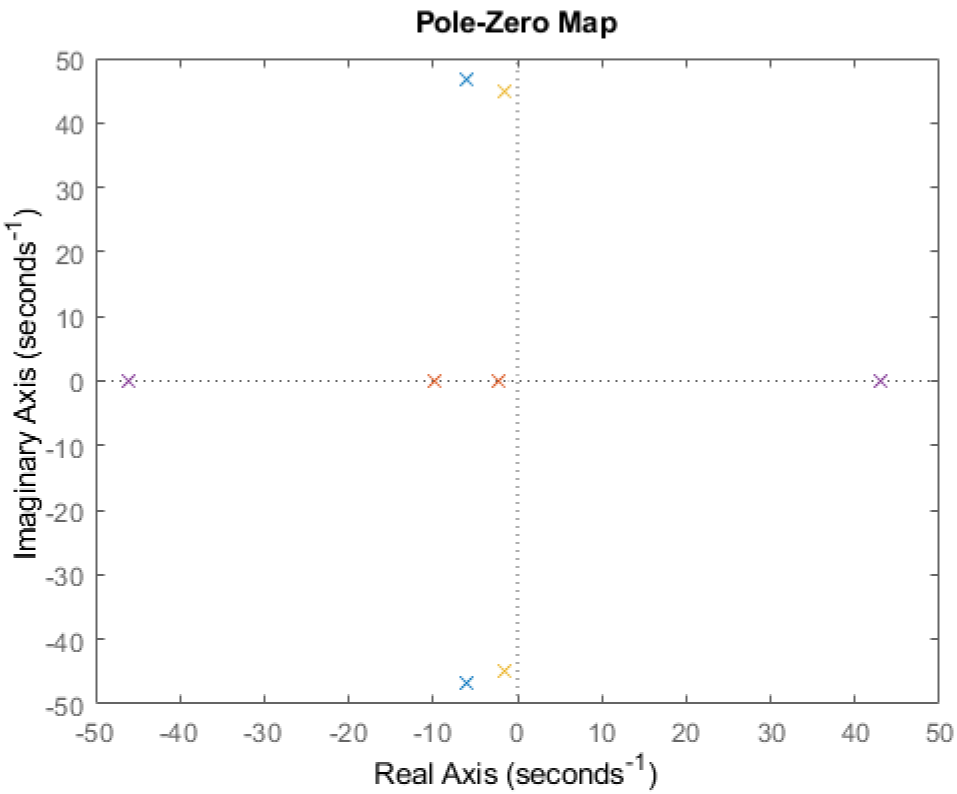
```
sys =

          2
  ------------------
  s^2 + 12 s + 20.02

Continuous-time transfer function.


NCTF1 =

          2
  ------------------
  s^2 + 12 s + 22.02

Continuous-time transfer function.


S =

  struct with fields:

        RiseTime: 1.0161
    SettlingTime: 1.8471
     SettlingMin: 0.0819
     SettlingMax: 0.0907
       Overshoot: 0
      Undershoot: 0
            Peak: 0.0907
        PeakTime: 3.0168


wn =

    2.2610
    9.7390


zeta =

     1
     1


CF =

    10


sys =

       2000
  --------------
  s^2 + 3 s + 22
```

```
Continuous-time transfer function.


NCTF2 =

        2000
  ----------------
  s^2 + 3 s + 2022

Continuous-time transfer function.


S =

  struct with fields:

        RiseTime: 0.0238
    SettlingTime: 2.5921
     SettlingMin: 0.1871
     SettlingMax: 1.8798
       Overshoot: 90.0453
      Undershoot: 0
            Peak: 1.8798
        PeakTime: 0.0699


wn =

   44.9667
   44.9667


zeta =

    0.0334
    0.0334


CF =

    10


sys =

      -2000
  --------------
  s^2 + 3 s + 22

Continuous-time transfer function.


NCTF3 =
```

```
       -2000
  ----------------
  s^2 + 3 s - 1978

Continuous-time transfer function.


S =

  struct with fields:

        RiseTime: NaN
    SettlingTime: NaN
     SettlingMin: NaN
     SettlingMax: NaN
       Overshoot: NaN
      Undershoot: NaN
            Peak: Inf
        PeakTime: Inf


wn =

    43
    46


zeta =

    -1
     1
```




```
figure
hold on
pzmap(NCTF)
pzmap(NCTF1)
pzmap(NCTF2)
pzmap(NCTF3)
```



Analysis:

```
%1. For negative variables the root of a system becomes positive so
 the syste
%m is unstable.
%2. Rise time of negative feedback closed loop system is less when
 compared
% to open loop system of the same second order.
%3. Zeros & Poles locations got changed when we added a negative feed
 back.
%4. System becomes under damped
%5. Overshoot is high when compared to open loop system.
%6. For the 3rd negative variables risetime, passtime every other
 parametrs
%becomes inf.
```

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