

ss-new-1

April 18, 2021

1 RC circuit example, low-pass filter, state-space model

system dimension parameters

```
[1]: nb = 3;  
     nnm1 = 2;  
     ns = 1;  
     ni = 1;  
     #  
     nt = 2 * nb + nnm1;  
     no = nt - ns;
```

circuit parameters

```
[2]: R = 1e3;  
     C = 100e-6;
```

adjusted tableau matrix

```
[3]: T = [  
     1  1  0  0  0  0  0  0  0  0  
     0 -1  1  0  0  0  0  0  0  0  
     0  0  0  1  0 -1  0  0  0  0  
     0  0  0  0  1 -1  1  0  0  0  
     0  0  0  0  0  0 -1  0 -1  0  
     0  0  0  1  0  0  0  0  0  1  
     0 -R  0  0  1  0  0  0  0  0  
     0  0 -1  0  0  0  0  C  0  0  
     ];
```

reduced row echelon form

```
[4]: Trref = rref(T)
```

Trref =

Columns 1 through 7:

1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
---------	---------	---------	---------	---------	---------	---------

0.00000	1.00000	-0.00000	-0.00000	0.00000	0.00000	0.00000
0.00000	0.00000	1.00000	0.00000	0.00000	0.00000	0.00000
0.00000	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000
0.00000	0.00000	0.00000	0.00000	1.00000	0.00000	0.00000
0.00000	0.00000	0.00000	0.00000	0.00000	1.00000	-0.00000
0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Columns 8 through 10:

0.00000	0.00100	-0.00100
-0.00000	-0.00100	0.00100
0.00000	-0.00100	0.00100
0.00000	0.00000	1.00000
0.00000	-1.00000	1.00000
-0.00000	-0.00000	1.00000
-0.00000	1.00000	-0.00000
1.00000	-10.00000	10.00000

extract state-space model matrices

```
[5]: if (Trref(nt, nt) == 1)
      A = Trref(no + 1 : nt, nt + 1 : nt + ns)
      B = Trref(no + 1 : nt, nt + ns + 1 : nt + ns + ni)
      C = Trref(1 : no, nt + 1 : nt + ns)
      D = Trref(1 : no, nt + ns + 1 : nt + ns + ni)
    elseif
      disp('somethong wrong, possible algebraic degeneration')
    endif
```

A = -10
B = 10
C =

0.00100
-0.00100
-0.00100
0.00000
-1.00000
-0.00000
1.00000

D =

-0.00100
0.00100
0.00100

```
1.00000  
1.00000  
1.00000  
-0.00000
```

```
[6]: save Ap1 A  
save Bp1 B  
save Cp1 C  
save Dp1 D
```

find eigenfrequencies of the state-space model

```
[7]: poles = eig(A)
```

```
poles = -10
```

```
[8]: save polesp1 poles
```