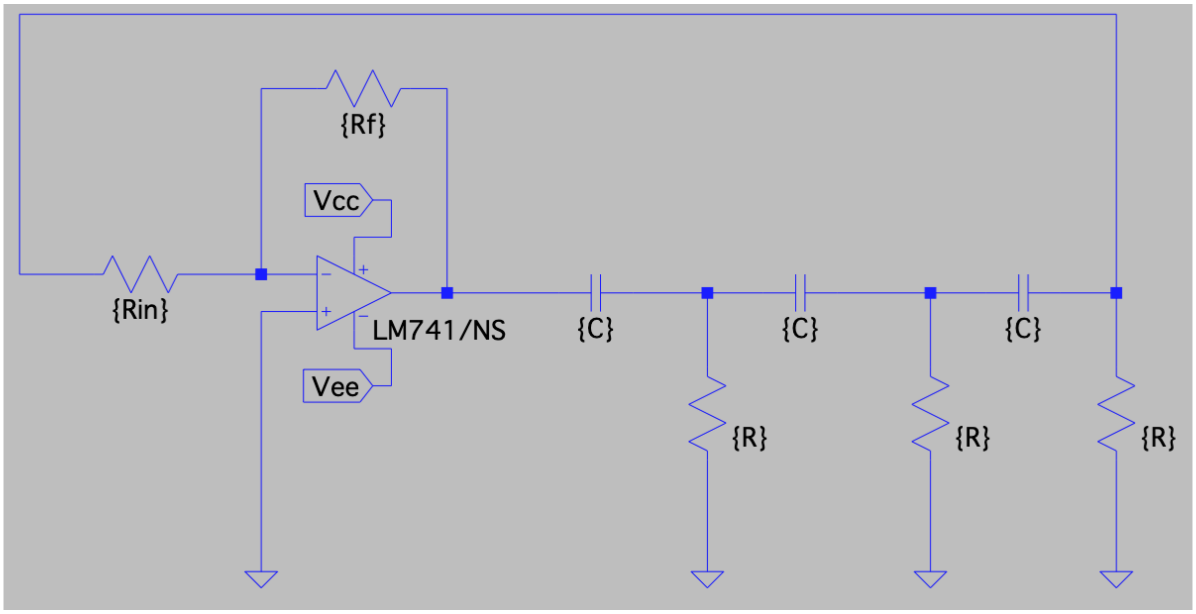
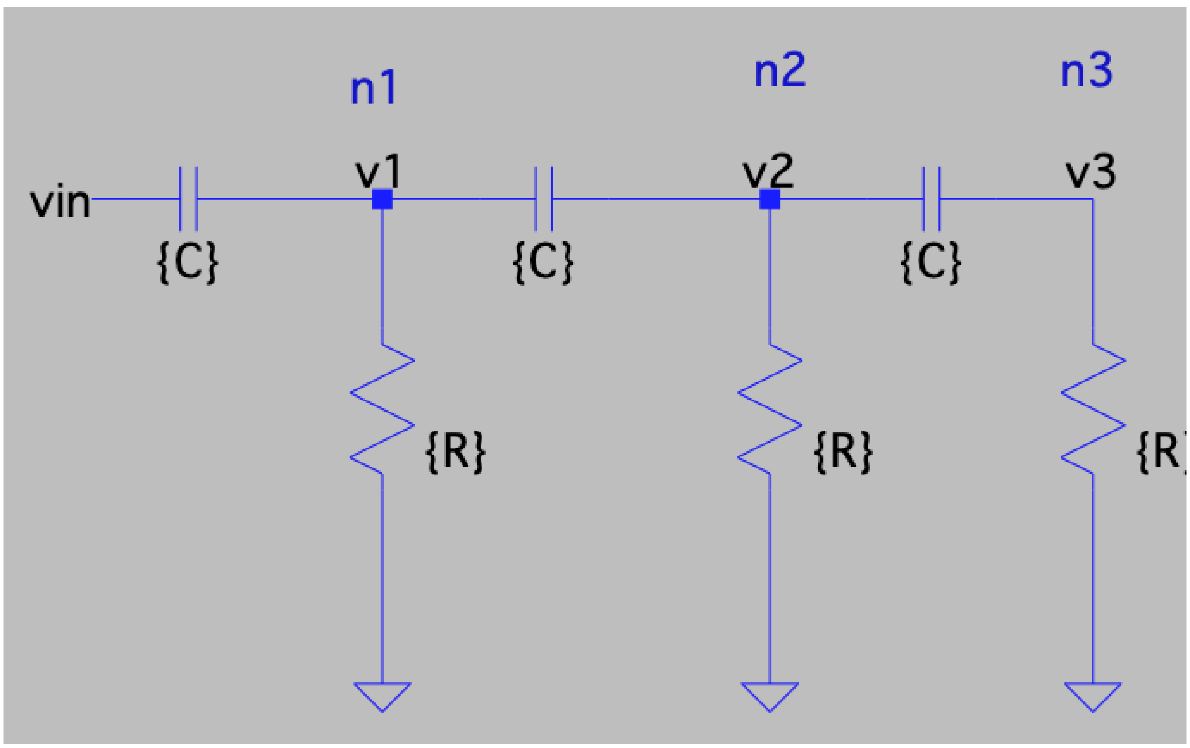
```
clear clc
syms vin v1 v2 v3 s c r n1 n2 n3 w H positive
```





Definindo os nos

```
n1 = (v1 - vin)/(1/(s*c)) + v1/r + (v1-v2)/(1/(s*c)) == 0
```

```
n1 =
```

$$\frac{v_1}{r} + c\,s\,(v_1 - v_2) + c\,s\,(v_1 - \mathrm{vin}) = 0$$

```
n2 = (v2 - v1)/(1/(s*c)) + v2/r + (v2-v3)/(1/(s*c)) == 0
```

n2 =

$$\frac{v_2}{r} - c\,s\,(v_1 - v_2) + c\,s\,(v_2 - v_3) = 0$$

```
n3 = (v3-v2)/(1/(s*c)) + v3/r == 0
```

n3 =

$$\frac{v_3}{r} - c\,s\,(v_2 - v_3) = 0$$

Isolando v2 a partir do no 3

```
v2 = solve(n3, v2)
```

v2 =

$$\frac{\frac{v_3}{r} + c\,s\,v_3}{c\,s}$$

Substituindo v2 no no 2

```
n2 = subs(n2)
```

n2 =

$$\frac{\frac{v_3}{r} + c\,s\,v_3}{c\,r\,s} - c\,s\left(v_3 - \frac{\frac{v_3}{r} + c\,s\,v_3}{c\,s}\right) - c\,s\left(v_1 - \frac{\frac{v_3}{r} + c\,s\,v_3}{c\,s}\right) = 0$$

Substituindo v2 no no 1

```
n1 = subs(n1)
```

n1 =

$$\frac{v_1}{r} + c\,s\left(v_1 - \frac{\frac{v_3}{r} + c\,s\,v_3}{c\,s}\right) + c\,s\,(v_1 - \mathrm{vin}) = 0$$

Isolando v1 no no 2

```
v1 = solve(n2, v1)
```

```
v1 =
```

$$\frac{v_3\,c^2\,r^2\,s^2+3\,v_3\,c\,r\,s+v_3}{c^2\,r^2\,s^2}$$

Aplicando v1 no no 1

```
n1 = subs(n1)
```

```
n1 =
```

$$\frac{v_3\,c^2\,r^2\,s^2+3\,v_3\,c\,r\,s+v_3}{c^2\,r^3\,s^2}-c\,s\,\left(\mathrm{vin}-\sigma_1\right)-c\,s\,\left(\frac{\frac{v_3}{r}+c\,s\,v_3}{c\,s}-\sigma_1\right)=0$$

where

$$\sigma_1=\frac{v_3\,c^2\,r^2\,s^2+3\,v_3\,c\,r\,s+v_3}{c^2\,r^2\,s^2}$$

Isolando vin

```
vin = solve(n1, vin)
```

```
vin =
```

$$\frac{v_3\,c^3\,r^3\,s^3+6\,v_3\,c^2\,r^2\,s^2+5\,v_3\,c\,r\,s+v_3}{c^3\,r^3\,s^3}$$

```
  H = simplify(v3/vin)
```

```
H =
```

$$\frac{c^3\,r^3\,s^3}{c^3\,r^3\,s^3+6\,c^2\,r^2\,s^2+5\,c\,r\,s+1}$$

Fazendo s=jw

```
s = 1i*w;
H = subs(H)
```

```
H =
```

$$-\frac{c^3\,r^3\,w^3\,\mathrm{i}}{-c^3\,r^3\,w^3\,\mathrm{i}-6\,c^2\,r^2\,w^2+5\,c\,r\,w\,\mathrm{i}+1}$$

Feito isso precisamos isolar a parte real do denominado

```
[numH, denH] = numden(H);
    denHreal = subs(denH, 1i, 0);
```

Igualando a zero e extraindo W temos

```
denHreal = denHreal == 0
```

denHreal = $6\,c^2\,r^2\,w^2 - 1 = 0$

```
  w = solve(denHreal, w);

  w = simplify(w)
```

w =

$$\frac{\sqrt{6}}{6\,c\,r}$$

Agora, para demonstrar o ganho substituimos a frequencia encontrada na equacao. Dessa forma:

```
A = subs(H)
```

A =

$$-\frac{1}{29}$$