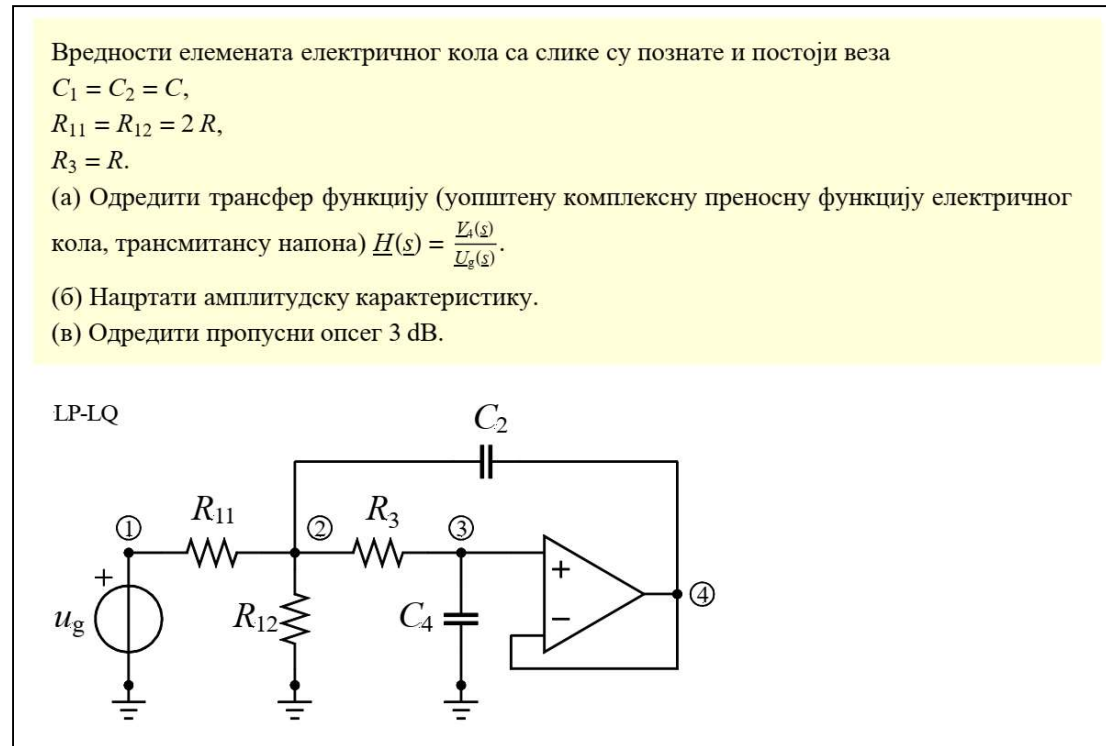


# Sallen & Key LP-LQ

## активни филтар

Figure 1: Филтар пропусник ниских учестности



```
(%i1) zamena: [C2=C, C4=C, R11=2*R, R12=2*R, R3=R];
```

```
(%o1) [C2=C, C4=C, R11=2*R, R12=2*R, R3=R]
```

```
(%i2) jednacine: [(V2-Ug)/R11+V2/R12+(V2-V3)/R3+(V2-V4)*C2*s=0,
(V3-V2)/R3+V3*C4*s=0, V3=V4];
```

```
(%o2) [C2*(V2-V4)*s + (V2-V3)/R3 + (V2-Ug)/R11 + V2/R12 = 0, C4*V3*s +
(V3-V2)/R3 = 0, V3=V4]
```

```
(%i3) odziv: linsolve(jednacine, [V2, V3, V4]);
```

```
(%o3) [V2=(C4*R12*R3*Ug*s+R12*Ug)/(C2*C4*R11*R12*R3*s^2 +
((C4*R12+C4*R11)*R3+C4*R11*R12)*s+R12+R11), V3=(R12*Ug)/(
C2*C4*R11*R12*R3*s^2 + ((C4*R12+C4*R11)*R3+C4*R11*R12)*s+R12+
R11), V4=(R12*Ug)/(C2*C4*R11*R12*R3*s^2 +
((C4*R12+C4*R11)*R3+C4*R11*R12)*s+R12+R11)]
```

```
(%i4) H: ev(V4/Ug, odziv), zamena, ratsimp;
```

```
(%o4) 1
      2 2 2
      2 C R s + 4 C R s + 2
```

```
(%i5) Hw: H, s=%i·w;
```

```
(%o5) 
$$\frac{1}{-2 C^2 R^2 w^2 + 4 \%i C R w + 2}$$

```

```
(%i6) assume(C>0, R>0, w>0);
```

```
(%o6) [C>0, R>0, w>0]
```

```
(%i7) M: cabs(Hw), ratsimp;
```

```
(%o7) 
$$\frac{1}{\sqrt{4 C^4 R^4 w^4 + 8 C^2 R^2 w^2 + 4}}$$

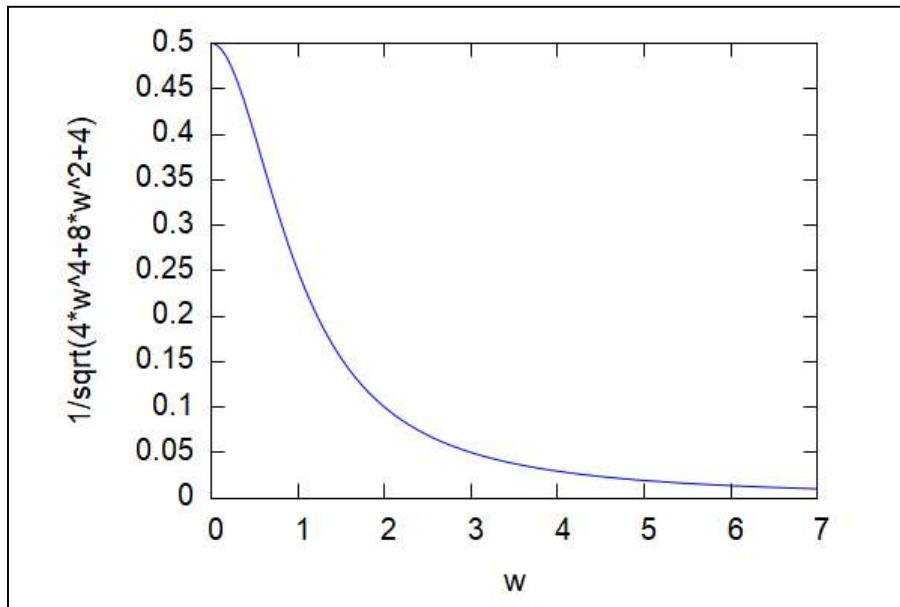
```

```
(%i8) zamene:[C=1, R=1];
```

```
(%o8) [C=1, R=1]
```

```
(%i9) wxplot2d(ev(M,zamene), [w,0, 7]);
```

```
(%t9)
```



```
(%o9)
```

```
(%i10) Aref: M, w=0;
```

```
(%o10) 
$$\frac{1}{2}$$

```

```
(%i11) P: Hw·subst(-w,w,Hw), ratsimp;
```

```
(%o11) 
$$\frac{1}{4 C^4 R^4 w^4 + 8 C^2 R^2 w^2 + 4}$$

```

```
(%i12) w3dB: solve([P=Aref^2/2], w);
```

```
(%o12) 
$$\left[ w = -\frac{\sqrt{\sqrt{2}-1}}{C R}, w = \frac{\sqrt{\sqrt{2}-1}}{C R}, w = -\frac{\sqrt{-\sqrt{2}-1}}{C R}, w = \frac{\sqrt{-\sqrt{2}-1}}{C R} \right]$$

```

```
(%i13) wg: w, w3dB[2];
```

```
(%o13)  $\frac{\sqrt{\sqrt{2-1}}}{C R}$ 
```

```
(%i14) B3dB: [0, wg];
```

```
(%o14)  $[0, \frac{\sqrt{\sqrt{2-1}}}{C R}]$ 
```