# IV Praktikum 2022

## Vorbereitungsteil:

### Aufgabe 1

$$|E| = \frac{1}{\sqrt{2}}1V,\ R_1 = R_2 = R = 50\Omega$$

### 1. Bestimmen Sie Pmax.

$$P_{max} = \frac{U_{eff}^2}{4R}$$

$$U_{eff}^2 = \left(\frac{|E|}{\sqrt{2}}\right)^2 \Rightarrow U_{eff}^2 = \left(\frac{1V}{\sqrt{4}}\right)^2 \Rightarrow \quad U_{eff}^2 = \frac{1V^2}{4}$$

$$P_{max} = \frac{\frac{1V^2}{4}}{4R} = \frac{1V^2}{16R} = \frac{1}{800}\frac{V^2}{\Omega} = 1,25\,\text{mW}$$

```
syms U_eff R E
P_max = U_eff^2/(4*R)
```

```
P_max =
```

$$\frac{U_{\text{eff}}^2}{4\,R}$$

```
P_max = double(subs(P_max,[U_eff,R],[1/2,50]))*1000  %W --> mW
```

```
P_max = 1.2500
```

### 2. Bestimmen Sie S21(jω).

$$S_{21} = k\frac{U_2}{E} = 2\sqrt{\frac{R_1}{R_2}\frac{U_2}{U_1}\frac{U_1}{E}} \ \Rightarrow\ S_{21} = 2\frac{U_2}{E}$$

$$U_2 = I * R_2$$

$$I = \frac{E}{R_{ges}} \qquad \Rightarrow\ U_2 = \frac{E}{R_{ges}}R_2 \rightarrow S_{21} = 2\frac{R_2}{R_{ges}}$$

$$R_{ges} = R + C||R$$

$$C||R = \frac{1}{j\omega C + \frac{1}{R}} \qquad \Rightarrow \qquad R_{ges} = R + \frac{1}{j\omega C + \frac{1}{R}}$$

$$S_{21} = 2\frac{R}{R+\frac{R}{j\omega CR+1}} = \frac{2}{1+\frac{1}{j\omega CR+1}} = \frac{2}{\frac{j\omega CR+1}{j\omega CR+1}+\frac{1}{j\omega CR+1}} = \frac{2}{\frac{j\omega CR+2}{j\omega CR+1}} = 2\frac{j\omega CR+1}{j\omega CR+2} = \frac{2\omega CR-2j}{\omega CR-2j}$$

```
syms R omega C
R_ges = R + 1/(1i*omega*C+1/R);
S_21 = 2*R/R_ges
```

S_21 =

$$\frac{2\,R}{R+\frac{1}{\frac{1}{R}+C\,\omega\,\mathrm{i}}}$$

```
simplify(S_21,"Steps",640)
```

ans =

$$2-\frac{2}{2+C\,R\,\omega\,\mathrm{i}}$$

### 3. Bestimmen Sie |S21(jω)|² und AdB(ω).

```
simplify(abs(S_21)^2,"Steps",3)
```

ans =

$$\frac{4\,|C\,R\,\omega-\mathrm{i}|^2}{|C\,R\,\omega-2\,\mathrm{i}|^2}$$

```
S21_abs_quad = (4*C^2*R^2*omega^2)/(C^2*R^2*omega^2 + 4) + 4/(C^2*R^2*omega^2 + 4)
```

S21_abs_quad =

$$\frac{4}{C^2\,R^2\,\omega^2+4}+\frac{4\,C^2\,R^2\,\omega^2}{C^2\,R^2\,\omega^2+4}$$

```
simpS21_abs_quad = simplify(S21_abs_quad,"Steps",10)
```

simpS21_abs_quad =

$$4-\frac{12}{C^2\,R^2\,\omega^2+4}$$

```
A_db = -10*log10(1/simpS21_abs_quad)
```

A_db =

$$-\frac{10\log\left(-\frac{1}{\frac{12}{C^2\,R^2\,\omega^2+4}-4}\right)}{\log(10)}$$

```
simA_db = simplify(A_db,"Steps",10)
```

```
simA_db =
```

$$-\frac{10\log\left(\frac{C^2R^2\omega^2+4}{4C^2R^2\omega^2+4}\right)}{\log(10)}$$

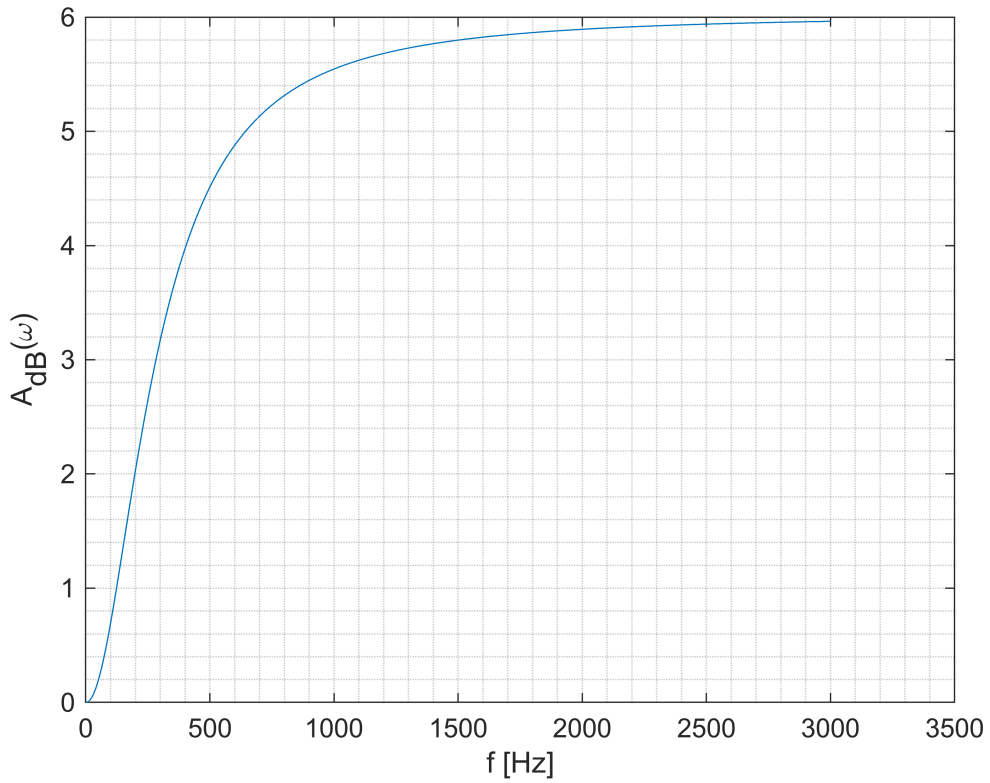
**4. Zeichnen Sie AdB(ω) qualitativ.**

```
syms A_dB(omega)
A_dB = symfun(simA_db,[C,R,omega])
```

```
A_dB(C, R, omega) =
```

$$-\frac{10\log\left(\frac{C^2R^2\omega^2+4}{4C^2R^2\omega^2+4}\right)}{\log(10)}$$

```
plot((A_dB(0.1,50,0:1/1000:3)))%Welche Werte für C?
xlabel ("f [Hz]")
ylabel("A_{dB}(\omega)")
grid("minor")
```




**5. Handelt es sich um ein Hochpass- oder ein Tiefpassfilter? Begründen Sie Ihre Antwort.**

Anhand des Plot ist die Dämpfung für hohe Freq. groß und für kleine Freq. klein. Das Verhalten spiegelt einen Tiefpass wieder