IV Praktikum 2022

Vorbereitungsteil:

Aufgabe 1

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

a) $P_{max} = \dfrac{U_{eff}^2}{4R}$

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

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

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

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

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P_max = double(subs(P_max,[U_eff,R],[1/2,50]))*1000   %W --> mW
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P_max = 1.2500

b)

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

$$U_2 = I * R_2$$

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

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

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

1

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

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

$$\frac{2\,R}{R+\dfrac{1}{\dfrac{1}{R}+C\,j\,\omega}}$$

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simplify(S_21,"Steps",10)
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ans =

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