

Kurzlösung Abgabe 4:

Aufgabe 22

$$a) \underline{F}(j\omega) = -R g_m \frac{(1 - j\omega \frac{C_{GD}}{g_m})}{1 + j\omega(C_{GS}R_o + C_{GD}(R_o + R + g_m R_o R) + C_j R + (j\omega)^2(C_{GS}C_{GD} + C_{GS}C_j + C_{GD}C_j)R_o R)}$$

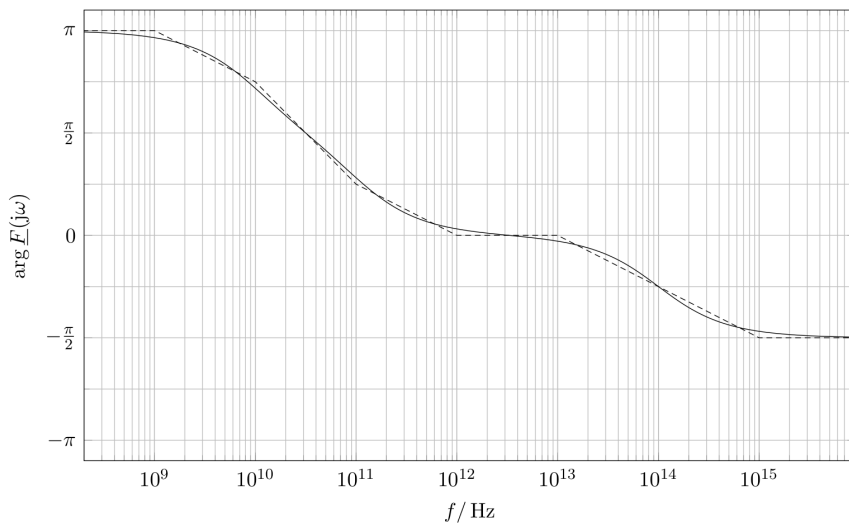
$$b) f_0 = 10^{11} \text{ Hz}, f_1 = 10^{10} \text{ Hz}, f_2 = 10^{14} \text{ Hz}$$

$$c) g_m = \omega_0 C_{GD} = 4,40 \text{ mS}$$

$$R = \frac{|\underline{F}(j\omega)|}{g_m} = 1,03 \text{ k}\Omega, |\underline{F}(j\omega)| = 13,13 \text{ dB}$$

$$R_o = \frac{1}{(C_{GS}C_{GD} + C_{GS}C_j + C_{GD}C_j)R\omega_{12}^2} = 50 \text{ m}\Omega$$

d)



$$e) \underline{Y}_{in} = j\omega C_{GS} + j\omega C_{GD} \frac{g_m + \frac{1}{R}}{j\omega C_{GD} + \frac{1}{R}} \xrightarrow{\omega C_{GD} R \ll 1} \underline{Y}_{in} \approx j\omega C_{GS} + j\omega C_{GD} \frac{g_m R + 1}{1}$$

$$f) \text{ für Leistungsanpassung: } \frac{1}{R_o} = \underline{Y}_{in} + \underline{Y}$$

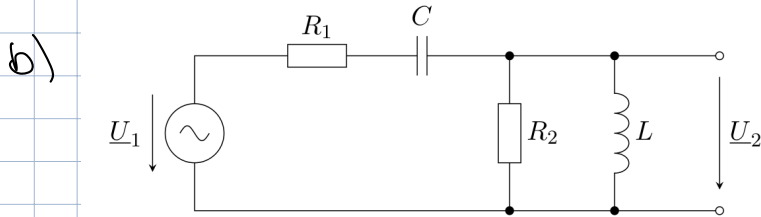
$$\Rightarrow \underline{Y} = \frac{1}{R_o} - j\omega C_{GS} = G + \frac{1}{j\omega L}$$

$$\Rightarrow G = \frac{1}{R_o}, L = \frac{1}{\omega^2 C_{GS}}$$

Aufgabe 23:

a) $\underline{Z}_1 = j\omega \underbrace{C R^2}_L$

Spulen sind deutlich schwieriger zu integrieren als Kapazitäten



Serienschwingkreis mit zusätzlichem Dämpfungselement R_2

c) Die Güte ist als das Verhältnis der Spannung an einem Energiespeicher zur Gesamtspannung bei Resonanz definiert.
 R_1 klein, R_2 groß

d)
$$\underline{F}(j\omega) = \frac{(j\omega)^2 LC}{1 + j\omega \left(\frac{L}{R_2} + C R_1 \right) + (j\omega)^2 LC \left(1 + \frac{R_1}{R_2} \right)}$$

e) $p_{01} = p_{02} = 0$

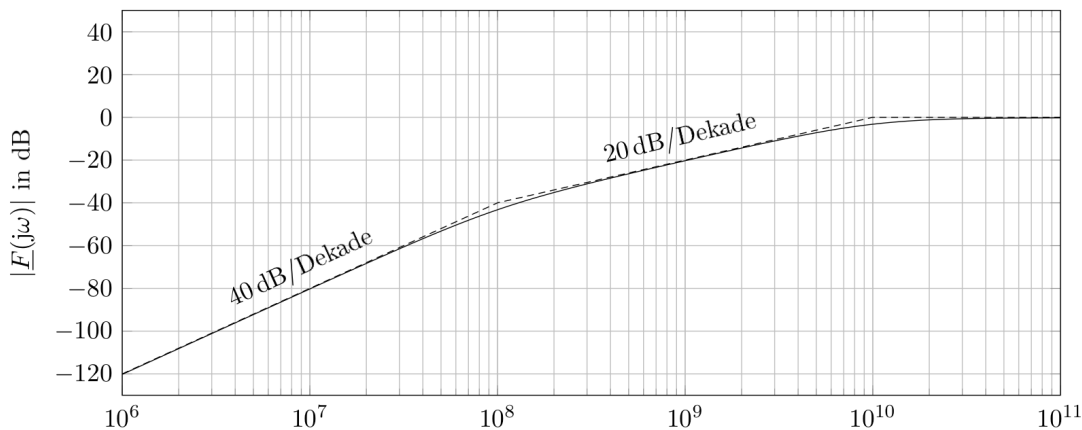
$$p_{001} = -6,283 \cdot 10^{10} \text{ s}^{-1} \Rightarrow f_1 = 10 \text{ GHz}$$

$$p_{002} = -6,289 \cdot 10^8 \text{ s}^{-1} \Rightarrow f_2 = 100 \text{ MHz}$$

$$\text{0dB Frequenz } \omega_3 = \frac{1}{\sqrt{LC}} = 1 \text{ GHz}$$

Hochpass 2. Ordnung

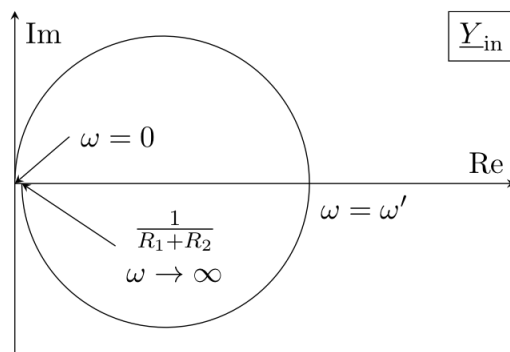
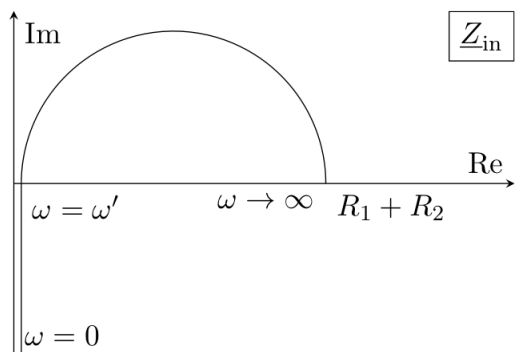
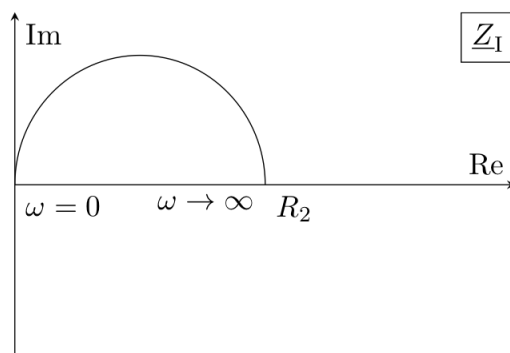
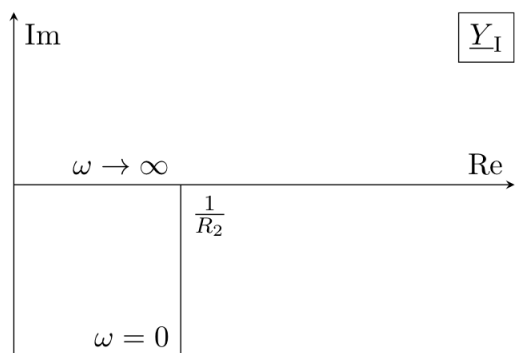
zu e): $R_1 = 650 \Omega$



$$f) \underline{z}_{in} = R_1 + \frac{1}{j\omega C} + \frac{j\omega L R_2}{j\omega L + R_2}$$

$$\operatorname{Im}\{\underline{z}_{in}\} \stackrel{!}{=} 0 \Rightarrow \omega' = 6,363 \cdot 10^9 \text{ s}^{-1}$$

$$\Rightarrow \underline{z}_{in}(\omega = \omega') = 650,2 \, \Omega$$

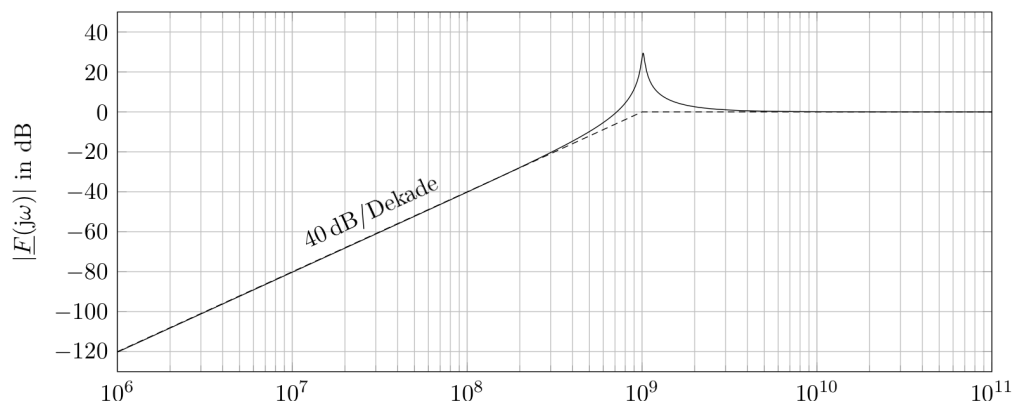


$$g) d = \frac{1}{2} \frac{\frac{L}{R_2} + CR_1}{\sqrt{LC(1 + \frac{R_1}{R_2})}} = 0,0169 < 1$$

$\Rightarrow$ kompl. konjugierte Polstellen

$\Rightarrow$ Resonanzüberhöhung mit $|F(j\omega)| = 29,6 \hat{=} 29,4 \text{ dB}$

zu g): $R_1 = 2 \, \Omega$



$$h) \quad d=1 \Rightarrow R_1 = \frac{2LC}{R_2} + \sqrt{\left(\frac{2LC}{R_2}\right)^2 - 4C^2\left(\frac{L^2}{R_2^2} - 4LC\right)} = 127,4 \, \Omega$$

zu h): $R_1 = 127,4 \, \Omega$

