1 Push-pull série auto-déphaseur

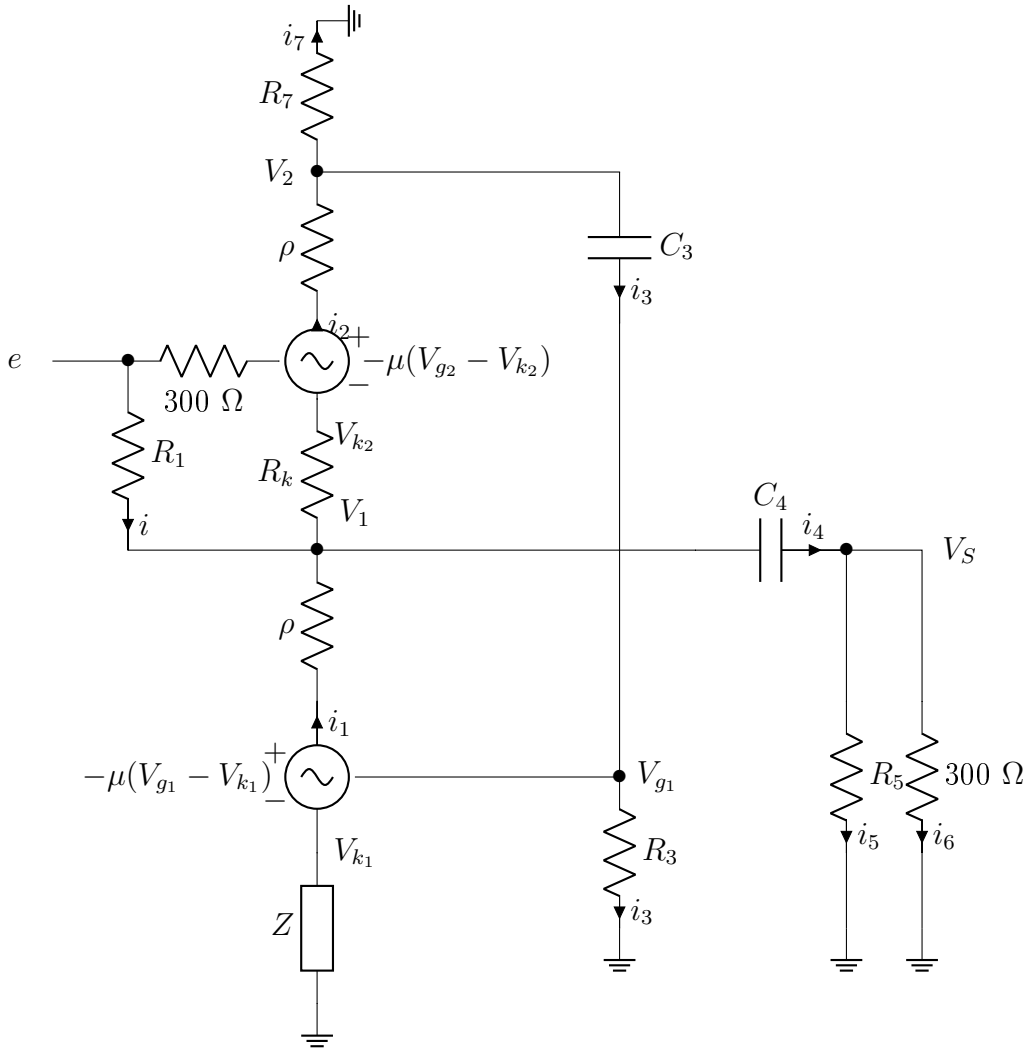

Figure 1: Circuit équivalent petits signaux

$$\begin{cases} i + i_1 - i_2 - i_4 = 0 \\ i_2 - i_3 - i_7 = 0 \\ i_4 - i_5 - i_6 = 0 \\ V_1 - V_{k_1} + \mu V_{g_1} - \mu V_{k_1} + \rho i_1 = 0 \\ V_{k_1} + Z i_1 = 0 \Rightarrow i_1 = -\frac{V_{k_1}}{Z} \\ V_{g_1} - R_3 i_3 = 0 \Rightarrow i_3 = \frac{V_{g_1}}{R_3} \\ V_{k_2} - V_1 + R_k i_2 = 0 \Rightarrow i_2 = \frac{V_1}{R_k} - \frac{V_{k_2}}{R_k} \\ V_2 - V_{k_2} - \mu V_{k_2} + \rho i_2 = -\mu V_{g_2} \\ V_S - Z_S i_6 = 0 \Rightarrow i_6 = \frac{V_S}{Z_S} \\ V_S - R_5 i_5 = 0 \Rightarrow i_5 = \frac{V_S}{R_5} \\ V_1 - V_S - Z_4 i_4 = 0 \Rightarrow i_4 = \frac{V_1}{Z_4} - \frac{V_S}{Z_4} \\ V_2 - V_{g_1} - Z_3 i_3 = 0 \\ V_1 + R_1 i = V_{g_2} \Rightarrow i = -\frac{V_1}{R_1} + \frac{V_{g_2}}{R_1} \\ V_2 - R_7 i_7 = 0 \Rightarrow i_7 = \frac{V_2}{R_7} \end{cases} \Rightarrow \begin{cases} \frac{V_{g_2}}{R_1} - \frac{V_1}{R_1} - \frac{V_{k_1}}{Z} + \frac{V_{k_2}}{R_k} - \frac{V_1}{R_k} - \frac{V_1}{Z_4} + \frac{V_S}{Z_4} = 0 \\ \frac{V_1}{R_k} - \frac{V_{k_2}}{R_k} - \frac{V_{g_1}}{R_3} - \frac{V_2}{R_7} = 0 \\ \frac{V_1}{Z_4} - \frac{V_S}{Z_4} - \frac{V_S}{R_5} - \frac{V_S}{Z_S} = 0 \\ V_1 - V_{k_1} + \mu V_{g_1} - \mu V_{k_1} - \rho \frac{V_{k_1}}{Z} = 0 \\ V_2 - V_{k_2} - \mu V_{k_2} - \rho \frac{V_{k_2}}{R_k} + \rho \frac{V_1}{R_k} = -\mu V_{g_2} \\ V_2 - V_{g_1} - Z_3 \frac{V_{g_1}}{R_3} = 0 \end{cases}$$

Soit, sous forme matricielle :

$$\begin{pmatrix} 0 & -\frac{1}{Z} & \frac{1}{R_k} & -\frac{1}{R_1}-\frac{1}{Z_4}-\frac{1}{R_k} & 0 & \frac{1}{Z_4} \\ -\frac{1}{R_3} & 0 & -\frac{1}{R_k} & \frac{1}{R_k} & -\frac{1}{R_7} & 0 \\ 0 & 0 & 0 & \frac{1}{Z_4} & 0 & -\frac{1}{Z_4}-\frac{1}{R_5}-\frac{1}{Z_S} \\ \mu & -1-\mu-\frac{\rho}{Z} & 0 & 1 & 0 & 0 \\ 0 & 0 & -1-\frac{\rho}{R_k}-\mu & \frac{\rho}{R_k} & 1 & 0 \\ -1-\frac{Z_3}{R_3} & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} V_{g_1} \\ V_{k_1} \\ V_{k_2} \\ V_1 \\ V_2 \\ V_S \end{pmatrix} = \begin{pmatrix} -\frac{V_{g_2}}{R_1} \\ 0 \\ 0 \\ 0 \\ -\mu V_{g_2} \\ 0 \end{pmatrix}$$

avec :

$$\begin{cases} \frac{1}{Z} = \frac{1}{120} + 470.10^{-6}\omega j \\ R_k = 120 \\ R_1 = 470000 \\ Z_4 = \frac{1}{0{,}4715.10^{-6}\omega j} \\ R_3 = 470000 \\ R_7 = 120 \\ R_5 = 10000 \\ Z_S = 300 \\ \mu = 20 \\ \rho = 1800 \end{cases}$$

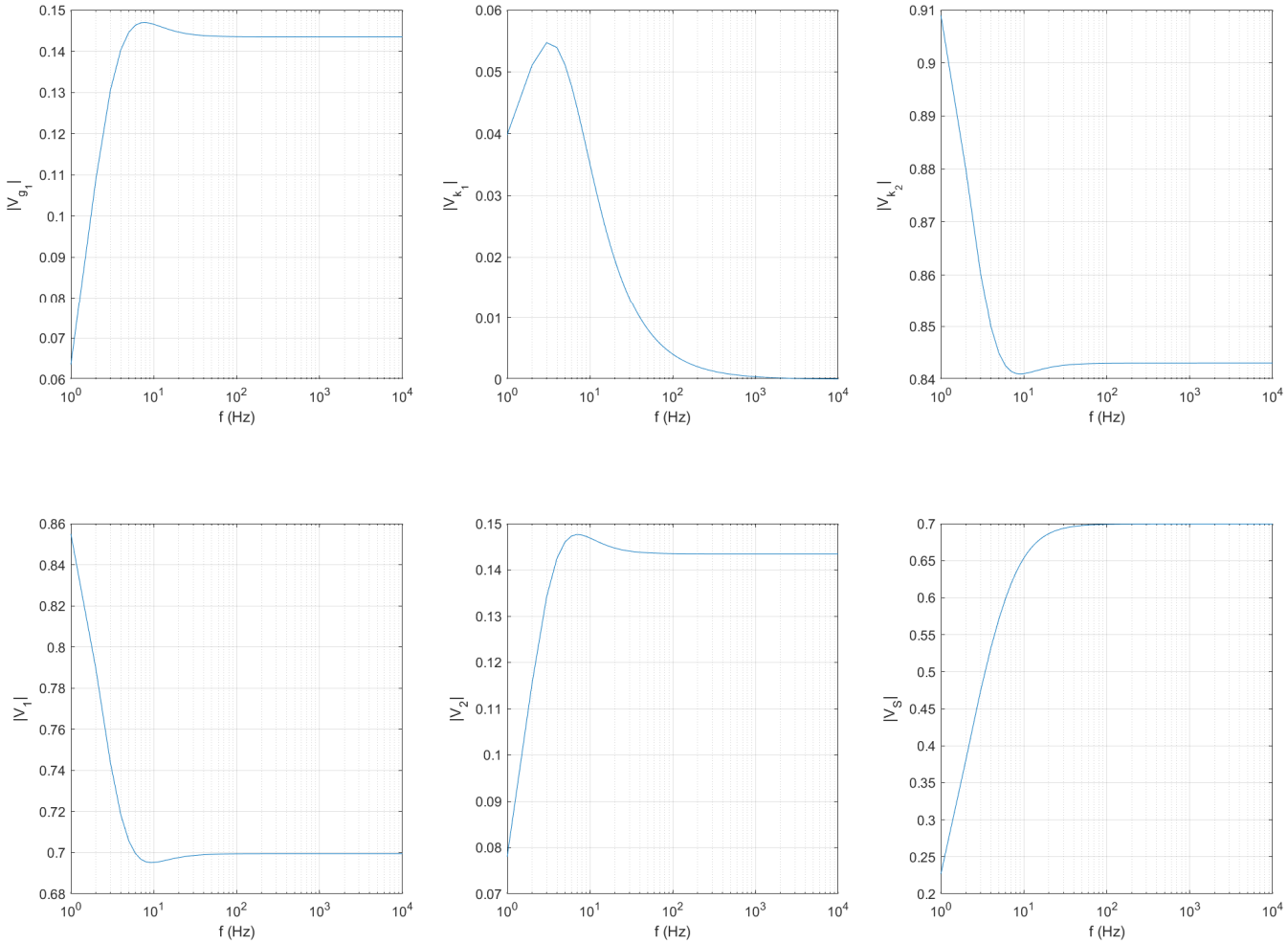

Figure 2: Amplitudes pour $e = 1$ V

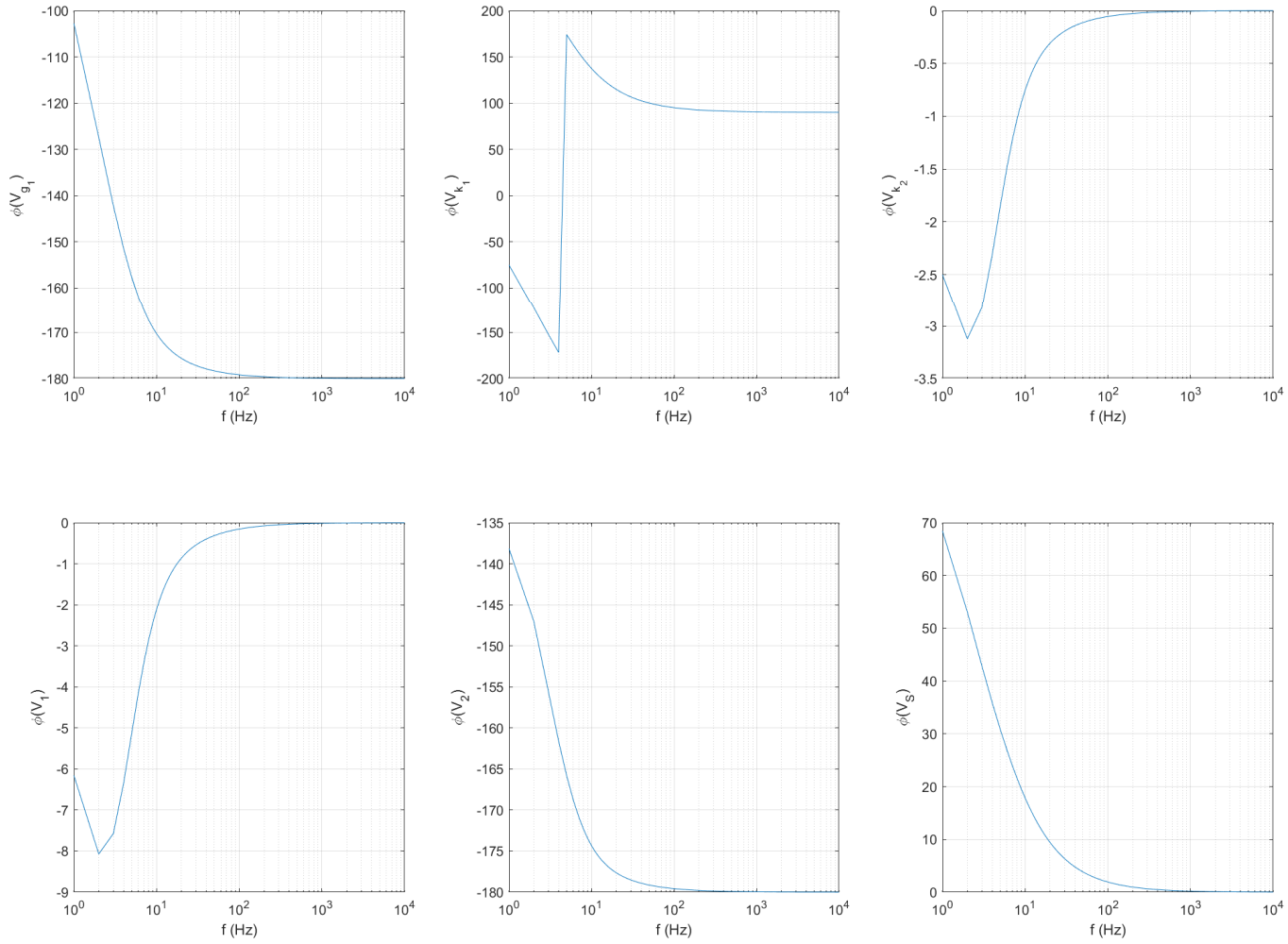

Figure 3: Ecart de phase par rapport à e