\[ \frac{v_o}{v_s} = A_{ce, L} = \frac{- (h_{21}a + h_{mf})}{y_{021} - (h_{21}a + h_{mf})(h_{21}a + h_{mf})} \]

\[ = \frac{- (h_{21}a + h_{mf})}{y_{021}} \frac{a}{1 + \frac{- (h_{21}a + h_{mf})}{y_{021}}(h_{21}a + h_{mf})} \]

\[ |h_{na}| >> |h_{mf}| \]

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\[ \text{unilateral flow assumption.} \Rightarrow a = -\frac{h_{na}}{y_{021}} \]

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\[ Z_i = \frac{a_i}{1 + T}, \quad Z_0 = \frac{Z_{in}}{1 + T} = \frac{1}{\frac{Z_{in}}{1 + T}} \]

**Example:**

\[ V_e = V_s - V_i \]

\[ h_{21a} = \frac{i_2}{i_1} \quad \frac{v_2}{v_1} = \frac{1}{R_e + R_f} \]

\[ h_{21b} = \frac{i_2}{i_1} \quad \frac{v_2}{v_1} = \frac{-R_e}{R_{in} + R_e} \]
\[ a = - \frac{h_{21a}}{g_{out} + g_{in}} = - \frac{-av z_i}{z_0} \left( \frac{1}{z_0} + \frac{1}{z_L + \frac{1}{R_E + R_F}} \right) \left( z_i + R_{E+R_F} \right) = \frac{z_i}{z_i + R_{E+R_F}} \cdot a_v \cdot \frac{z_L + R_{E+R_F}}{z_0 + z_L + R_{E+R_F}} \]
\[ a = \frac{z_i}{z_i + R_{E}R_{L}} \cdot a_{u} \cdot \frac{Z_{L11}(R_{E} + R_{F})}{Z_{0} + Z_{L11}(R_{E} + R_{F})} \]

\[ z_{in} = z_{i} + R_{E}R_{F} \quad z_{out} = Z_{0}Z_{L11}(R_{E} + R_{F}) \]

\[ z_{i} = z_{in}(1 + T) \quad z_{0} = \frac{z_{out}}{1 + T} \]
For $a_1$:

\[ g_{11} = \frac{i_1}{v_1} = \frac{R_E}{v_1 + R_E + R_F} \]

\[ g_{12} = \frac{i_2}{R_E} = \frac{1}{R_E} \]

\[ f = -\frac{R_E}{(R_F + R_E)\alpha_2} \]