ELEC 226
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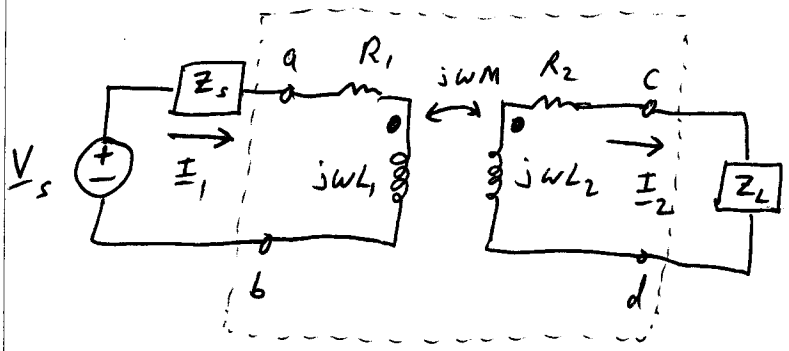
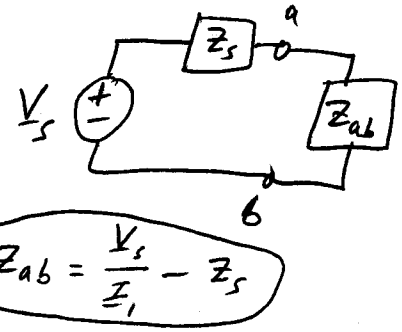
Linear Transformer Analysis





$$Z_{ab} = \frac{\underline{V}_s}{\underline{I}_1} - Z_s$$

$$\underline{V}_s = (Z_s + R_1 + j\omega L_1)\,\underline{I}_1 - j\omega M\,\underline{I}_2 = Z_{11}\,\underline{I}_1 - j\omega M\,\underline{I}_2$$

$$0 = -j\omega M\,\underline{I}_1 + (R_2 + j\omega L_2 + Z_L)\,\underline{I}_2 = -j\omega M\,\underline{I}_1 + Z_{22}\,\underline{I}_2$$

$$\underline{I}_1 = \frac{\begin{vmatrix} \underline{V}_s & -j\omega M \\ 0 & Z_{22} \end{vmatrix}}{\begin{vmatrix} Z_{11} & -j\omega M \\ -j\omega M & Z_{22} \end{vmatrix}} = \frac{Z_{22}\,\underline{V}_s}{Z_{11}Z_{22} + (\omega M)^2}$$

$$\underline{I}_2 = \frac{\begin{vmatrix} Z_{11} & \underline{V}_s \\ -j\omega M & 0 \end{vmatrix}}{\begin{vmatrix} Z_{11} & -j\omega M \\ -j\omega M & Z_{22} \end{vmatrix}} = \frac{j\omega M\,\underline{V}_s}{Z_{11}Z_{22} + (\omega M)^2} = \frac{j\omega M}{Z_{22}}\,\underline{I}_1$$