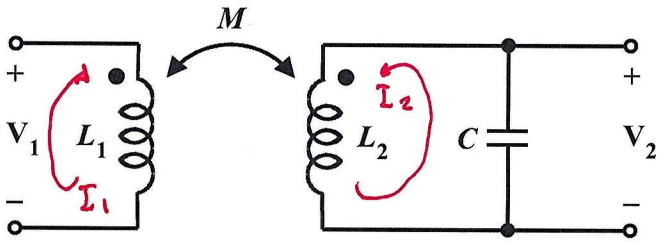
EE 3340

Homework Problem #035

Symbolically determine the voltage transfer function $\mathbf{V}_2/\mathbf{V}_1$.



$$j\omega L_1 I_1 + j\omega M I_2 = V_1 \qquad j\omega M I_1 + j\omega L_2 I_2 + \frac{1}{j\omega C} I_2 = 0$$

$$\begin{bmatrix} j\omega L_1 & j\omega M \\ j\omega M & j\omega L_2 + \frac{1}{j\omega C} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} V_1 \\ 0 \end{bmatrix}$$

$$I_2 = \frac{\begin{vmatrix} j\omega L_1 & V_1 \\ j\omega M & 0 \end{vmatrix}}{\begin{vmatrix} j\omega L_1 & j\omega M \\ j\omega M & j\omega L_2 + \frac{1}{j\omega C} \end{vmatrix}} = \frac{-j\omega M V_1}{j\omega L_1 \left(j\omega L_2 + \frac{1}{j\omega C} \right) + \omega^2 M^2}$$

$$V_2 = -\frac{1}{j\omega C} I_2 = \frac{M}{C} \frac{V_1}{-\omega^2 L_1 L_2 + \frac{L_1}{C} + \omega^2 M^2}$$

$$\Rightarrow \frac{V_2}{V_1} = \frac{M}{L_1 + \omega^2 C (M^2 - L_1 L_2)}$$