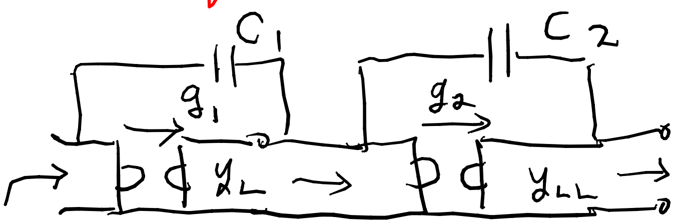
$\frac{dx}{dt}$, $x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$ in homework $\qquad$ 10/12/05

$x(0) = [\cdot, \cdot, \cdot, \cdot]^T$

= initial conditions

most A, W are constants ⟹ G works in PS since A_{44} & w ⟹ Gvalue works with these as parameters

Returning to cascade synthesis $\qquad$ see file even_part.pdf for detailed calculations



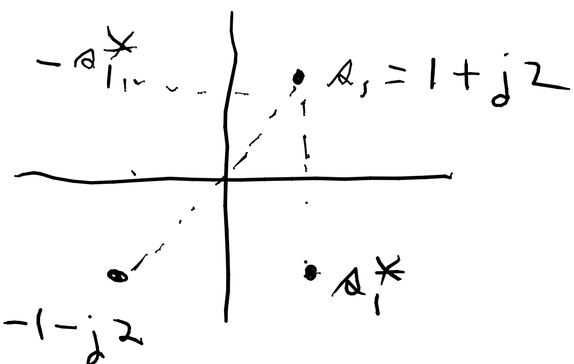
g1(k) = 0.847 + 0.188j

C1(k) = 0.245 − 0.301j

C2(k) = 0.118 + 0.471j

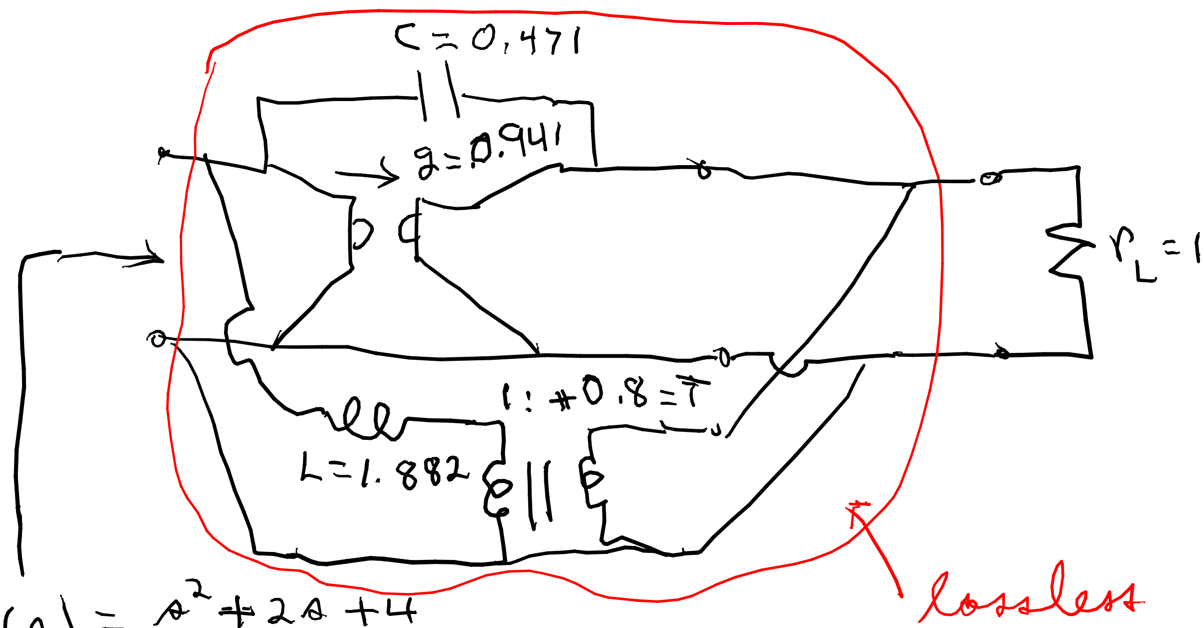
g2(k) = 1.059 + 0.235j

$$y(s) = \frac{s^2+as+b}{s^2+cs+d} = \frac{s^2+2s+4}{s^2+2.125s+6.25}\ ; \quad Ev\,y(s) = 0 \ @\ s = \pm(1+j2) \ \&\ \pm(1-j2)$$



$$Y(s) = Cs\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} + g\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} + \frac{1}{Ls}\begin{bmatrix} 1 & -\frac{1}{T} \\ -\frac{1}{T} & \frac{1}{T^2} \end{bmatrix}$$

$$= 0.471s\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} + 0.941\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} + \frac{1}{1.882s}\begin{bmatrix} 1 & -\frac{1}{0.8} \\ -\frac{1}{0.8} & \frac{1}{0.64} \end{bmatrix}$$



$$y(s) = \frac{s^2 + 2s + 4}{s^2 + 2.125s + 6.25}$$

Lossless: $P_{ave}(j\omega) \equiv 0$ for almost all ω

$s = \sigma + j\omega$ with $\sigma = 0$

Ex: admittance

$$P_{ave}(j\omega) = \mathrm{Re}\left(V^{T*}(j\omega)\, I(j\omega)\right)$$

$$= \frac{1}{2}\left[V^{T}(j\omega)^{*} I(j\omega) + I^{T}(j\omega)^{*} V(j\omega)\right]$$

$$= 2\left[V^{T*}(j\omega) Y(j\omega) V(j\omega) + V^{T*}(j\omega) Y^{T*}(j\omega) V(j\omega)\right]$$

$$= V^{T*}(j\omega)\left[\frac{1}{2}\left(Y(j\omega) + Y^{T*}(j\omega)\right)\right] V(j\omega) = 0_{1\times 1}$$

lossless

holds for all $V(j\omega)$ & "all" ω:

$$\therefore \quad Y(j\omega) + Y^{T*}(j\omega) = 0$$

if $Y(s)$ has real coefficients then $Y^{*}(j\omega) = Y(-j\omega)$

if rational also then this is zero on a ~~dense~~ dense set of s on $s=j\omega$; here $Y(-s)$ & $Y(s)$ are analytic functions $\Rightarrow$ $Y(s)+Y^T(-s)\equiv 0_n$ for all s.

For transistor models see the VLSI page accessed via the 610 web page (at bottom).