$$\theta = \omega t$$

$$= \omega_0 t + \delta$$

δ const.

$$\omega \neq \omega_0$$

$$\begin{bmatrix} f_a \\ f_b \\ f_c \end{bmatrix} = C_P \begin{bmatrix} f_d \\ f_q \\ f_0 \end{bmatrix} = C_K \begin{bmatrix} f_D \\ f_q \\ f_0 \end{bmatrix}$$

$$\begin{bmatrix} f_D \\ f_q \\ f_0 \end{bmatrix} = \underline{\underline{C_K^{-1} C_P}} \begin{bmatrix} f_d \\ f_q \\ f_0 \end{bmatrix}$$

$$\frac{(f_q + j f_D) = (f_q + j f_d) e^{j\delta}}{(\psi_q + j \psi_D) = (\psi_q + j \psi_d) e^{j\delta}}$$

$$(i_q + j\, i_D) = (i_q + j\, i_d) e^{j\delta}$$

$\psi_d i_q - \psi_q i_d$

$$T_e = \psi_D i_Q - \psi_Q i_D$$

(8) X

$$\frac{2H}{\omega_B}\frac{d\omega}{dt} = T_m - T_e$$

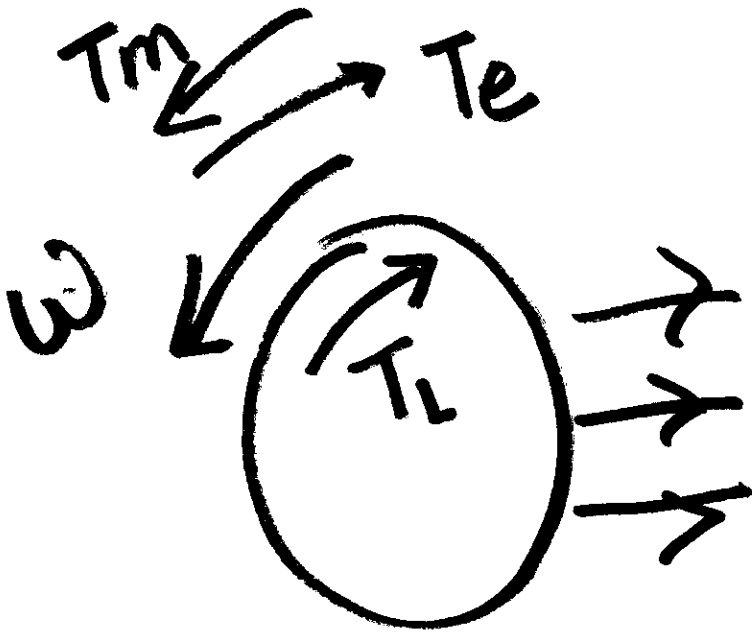
$+\delta$

$\psi_D \quad \psi_Q$

$\psi_{GK} \quad \psi_{FK}$

$\psi_d \quad \psi_q$

$\psi_G \quad \psi_K$



MOTOR

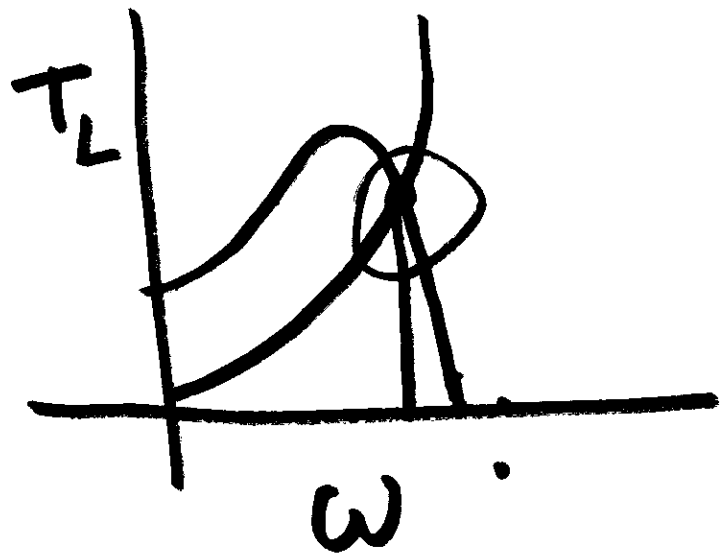
$$T_m = -T_L'$$

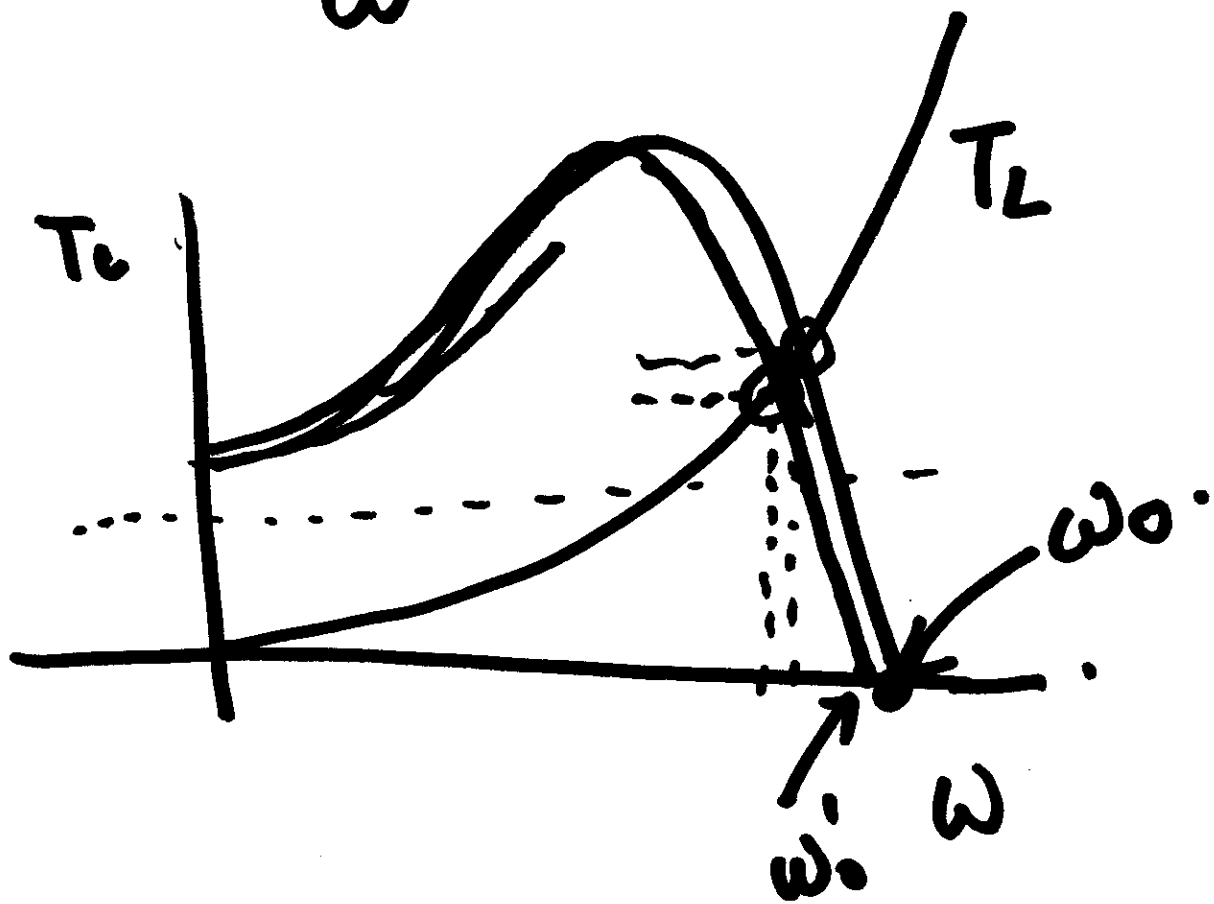
$$\frac{2H}{\omega_B}\frac{d\omega}{dt} = T_m - T_e$$

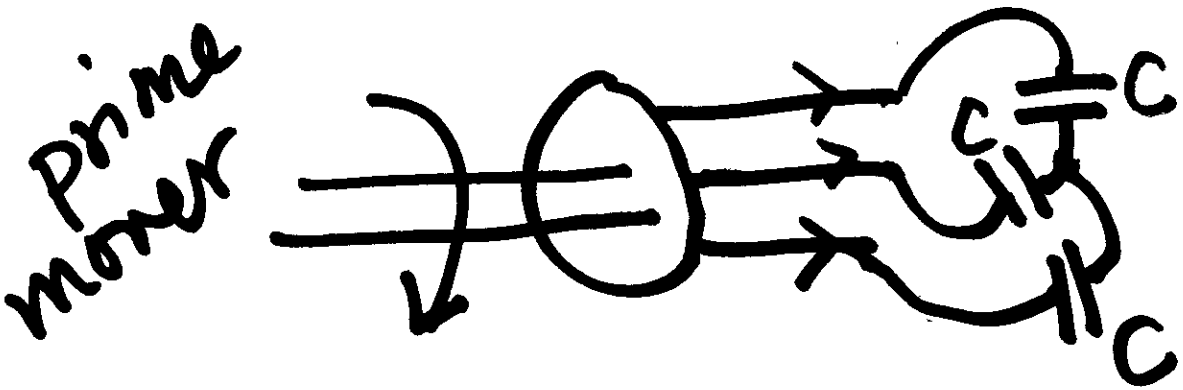
$$= T_m - (\psi_D i_q - \psi_q i_D)$$

$$= -T_L \pm (\psi_D i_q - \psi_q i_D).$$

(+)


T_L
ω


T_L
T_L
ω_0
ω_0
ω



$$C_K \cdot \begin{bmatrix} C & 0 & 0 \\ 0 & C & 0 \\ 0 & 0 & C \end{bmatrix} \begin{bmatrix} \frac{dV_{an}}{dt} \\ \frac{dV_{bn}}{dt} \\ \frac{dV_{cn}}{dt} \end{bmatrix} = \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix}$$

$$C\frac{dv_D}{dt} = -\omega_0 C v_Q + i_D$$

$$C\frac{dv_Q}{dt} = \omega_0 C v_D + i_Q .$$

$$\frac{dv_D}{dt} = -\omega_0 v_Q + i_D/C$$

$$\frac{dv_Q}{dt} = +\omega_0 v_D + i_Q/C .$$

PU FORM OF CAPACITOR EQUATIONS

$$\frac{dV_D}{dt} = -\omega_0 V_Q + \frac{i_D}{b_C}\omega_B$$

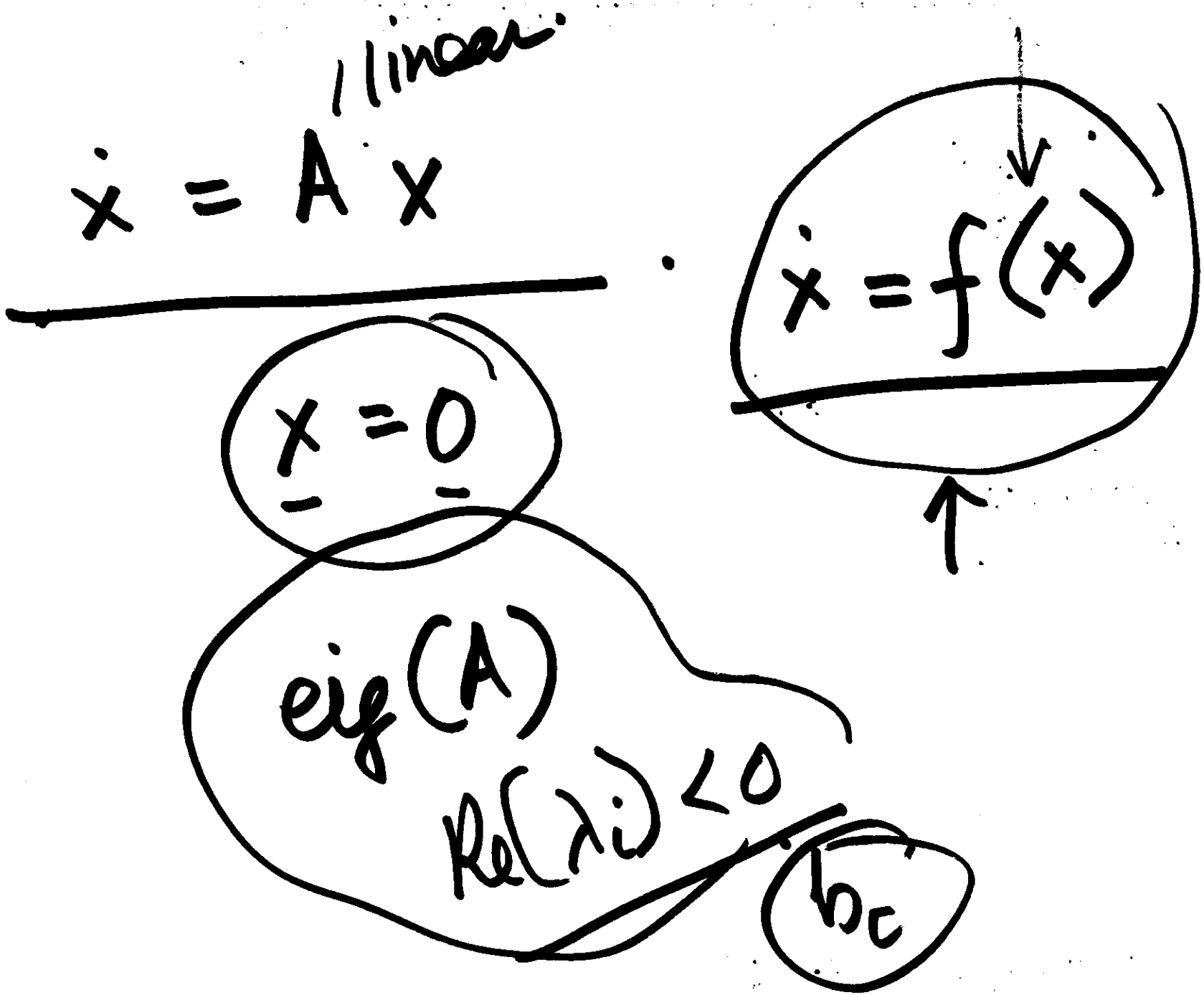
$$\frac{dV_C}{dt} = \omega_0 V_D + \frac{i_Q}{b_C}\omega_B$$

correction

$+ \psi_D, \psi_Q, \psi_{GK}, \psi_{FK}.$

C in pu $\rightarrow$ b_C in pu.

ω_B = base frequency


linear
$\dot{x} = Ax$
$\dot{x} = f(x)$
$x = 0$
$\underline{x} = \underline{0}$
eig(A)
$Re(\lambda_i) < 0$
b.c

$$i(x,t) = -f_1(x-ct) - f_2(x+ct)$$

$$v(x,t) = z_c f_1(x_1-ct) - z_c f_2(x+ct$$

$$\underline{R = G = 0}$$

$$c = \frac{1}{\sqrt{LC}} \qquad z_c = \sqrt{\frac{L}{C}}.$$

Ω

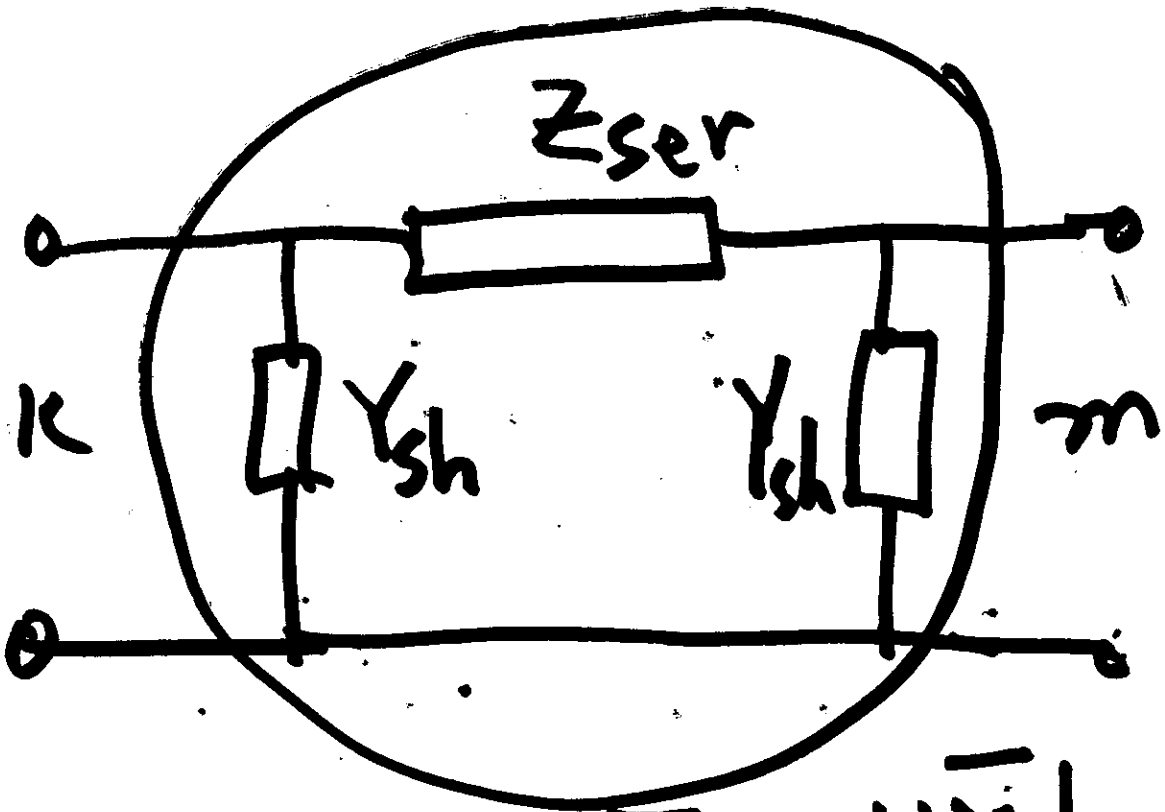
$$\bar{Z} = R\dot{d} + j\omega_s L\dot{d}$$

$$\bar{Y} = G\dot{d} + j\omega_s C\dot{d}$$

$\omega_s \rightarrow$ frequency.

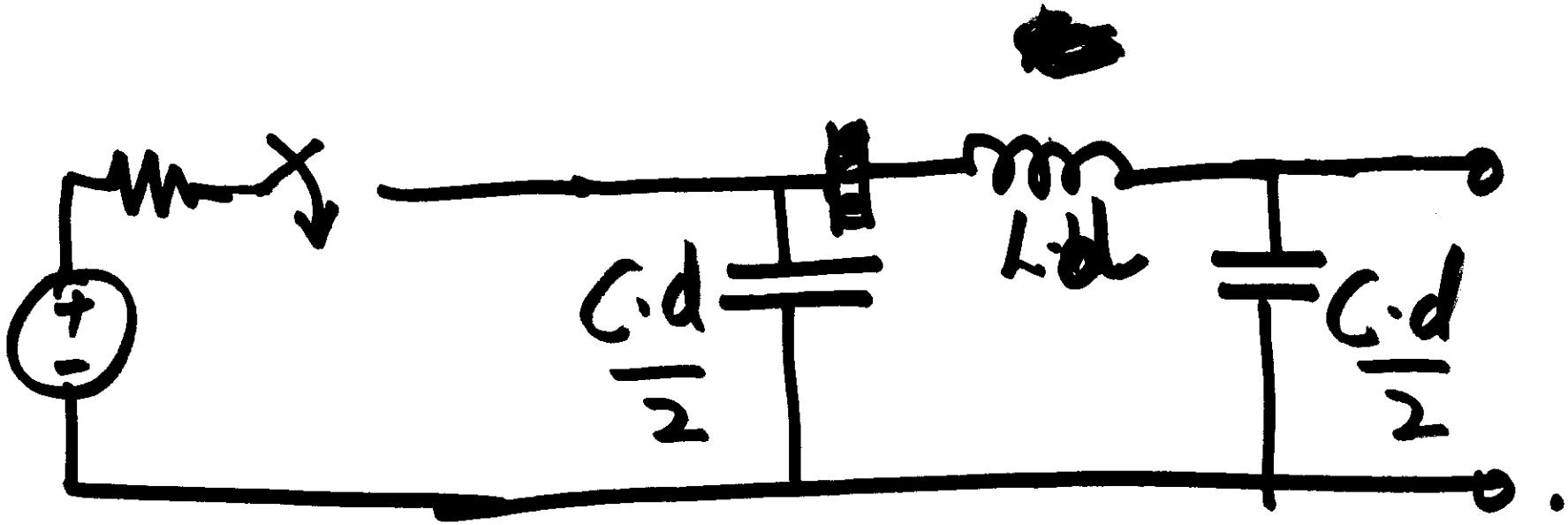
$$\bar{\gamma} = \sqrt{\bar{Z}\bar{Y}}$$

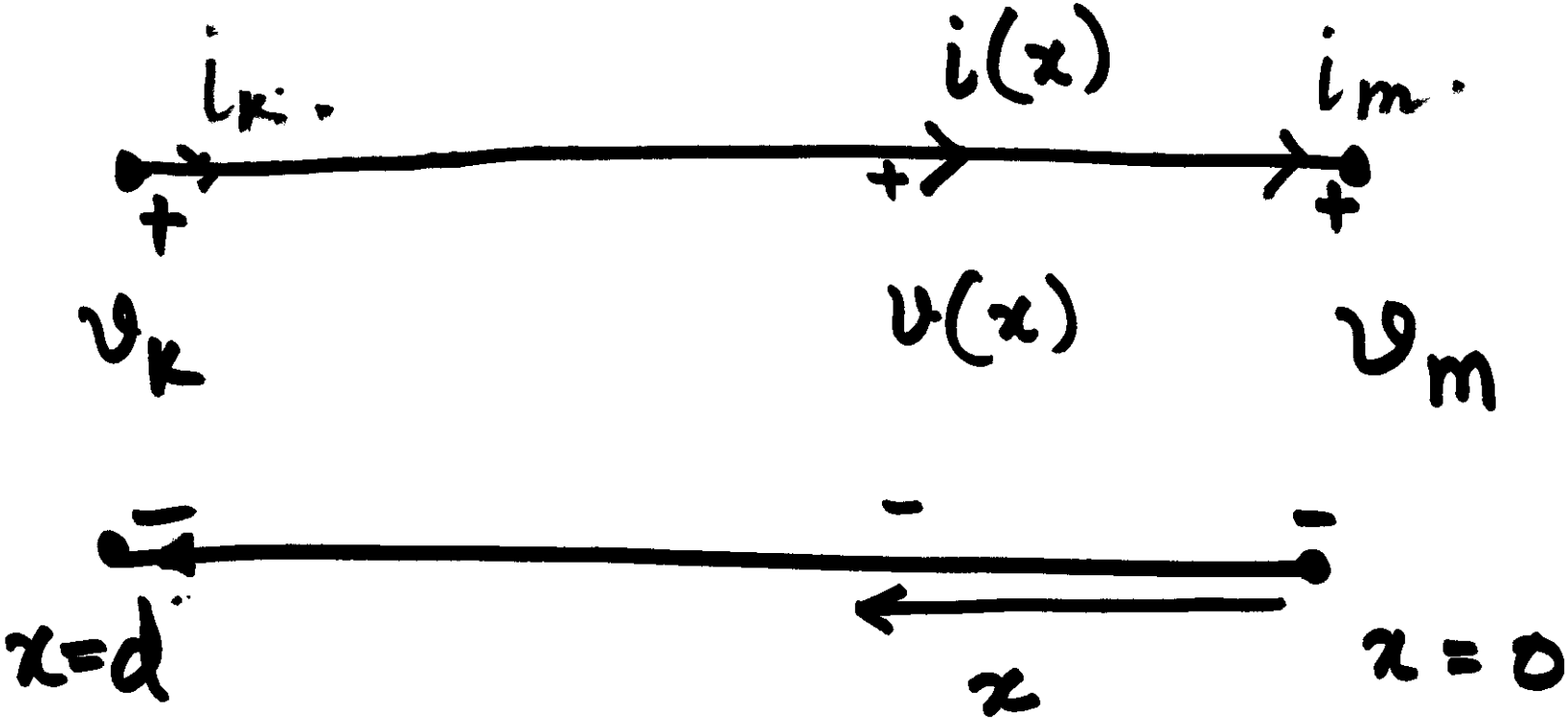
$$\frac{}{d^2}.$$



$$Z_{ser} = \bar{Z} \frac{\sinh \bar{\gamma} d}{\bar{\gamma} d} = A + jB$$

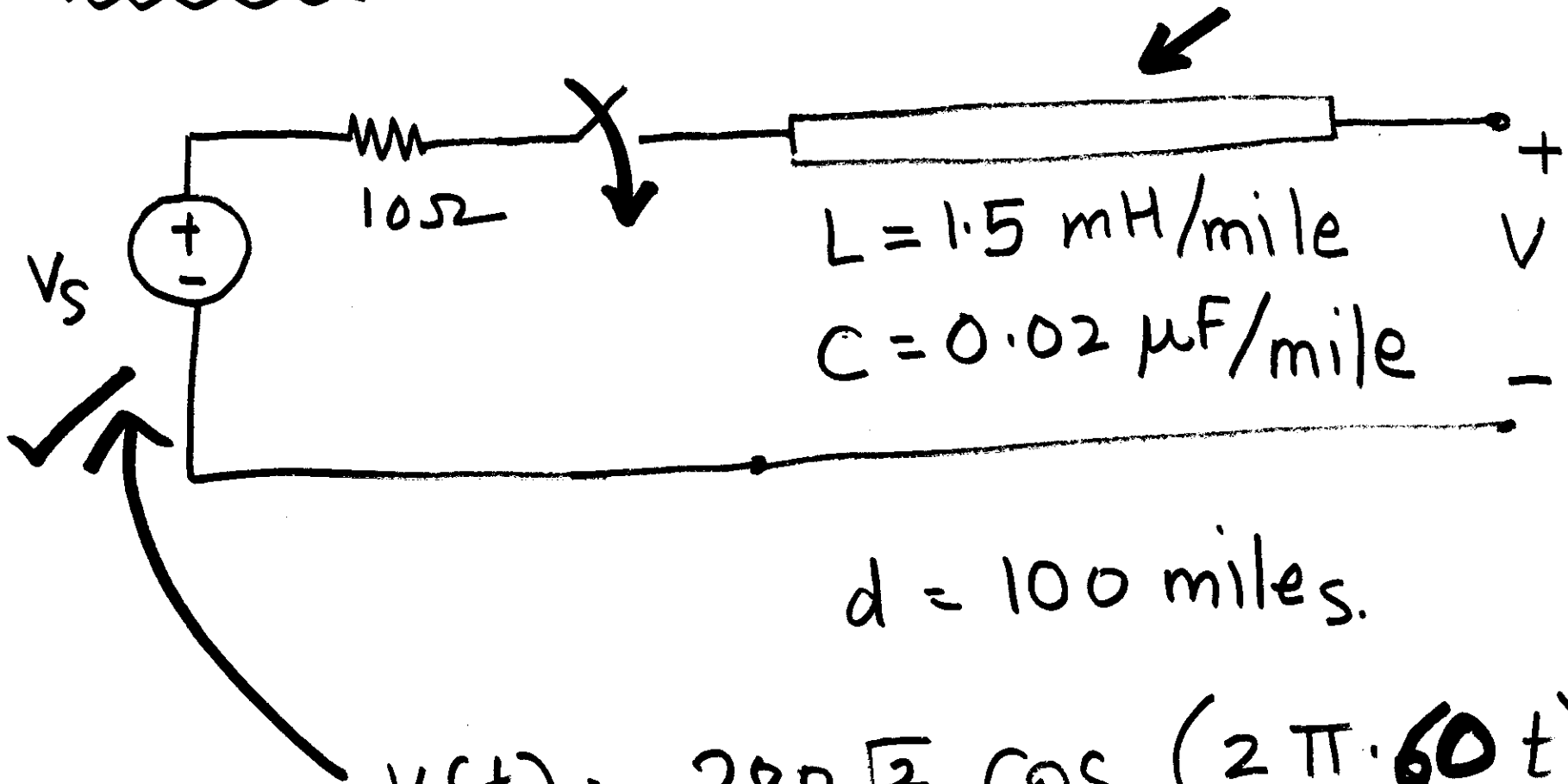
$$Y_{sh} = \frac{\bar{Y}}{2} \frac{\tanh \frac{\bar{\gamma} d}{2}}{\frac{\bar{\gamma} d}{2}}.$$


+
−
C·d/2
L·dz
C·d/2



$$\begin{cases} \dfrac{\partial v}{\partial x} = Ri + L\,\partial i/\partial t \\ \dfrac{\partial i}{\partial x} = Gv + C\dfrac{\partial v}{\partial t}. \end{cases}$$

EXAMPLE (Sauer & Pai)



d = 100 miles.

$$V_S(t) = 230\sqrt{\frac{2}{3}}\cos(2\pi \cdot 60\, t) \quad \text{kV}$$

h = 0.0001 s.

$$L\frac{di}{dt} = V_a - V_b$$