

$$A = \begin{bmatrix} \frac{-(R_1 + R_2)}{R_1 R_2 C_f} & \frac{1}{R_2 C_f} \\ \frac{1}{R_2 C_c} & \frac{-1}{R_2 C_c} \end{bmatrix}$$

$$B = \begin{bmatrix} \frac{-g}{C_f} \\ 0 \end{bmatrix} \quad C = [0 \quad 1] \quad F = \begin{bmatrix} \frac{1}{R_1 C_f} \\ 0 \end{bmatrix}$$

$$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \quad B = \begin{bmatrix} b \\ 0 \end{bmatrix} \quad C = [0 \quad 1]$$

$$A_0 = A - \begin{bmatrix} l_1 \\ l_2 \end{bmatrix} [0 \quad 1]$$

$$= \begin{bmatrix} a_{11} & a_{12} - l_1 \\ a_{21} & a_{22} - l_2 \end{bmatrix}$$

$$\det \left[sI - A_0 \right] = \det \left[\begin{bmatrix} s & 0 \\ 0 & s \end{bmatrix} - \begin{bmatrix} a_{11} & a_{12} - l_1 \\ a_{21} & a_{22} - l_2 \end{bmatrix} \right]$$

$$= \det \begin{bmatrix} s - a_{11} & -a_{12} + l_1 \\ -a_{21} & s - a_{22} + l_2 \end{bmatrix}$$

$$= (s - a_{11})(s - a_{22} + l_2) - (-a_{21})(-a_{12} + l_1)$$

$$= s^2 + (-a_{11} - a_{22} + l_2)s + (-a_{11})(-a_{22} + l_2) - (-a_{21})(-a_{12} + l_1)$$

$$= s^2 + (l_2 - a_{11} - a_{22})s + a_{11}a_{22} - a_{11}l_2 - a_{21}a_{12} + a_{21}l_1$$

two poles in the real plane:

$$s^2 + (p_1 + p_2)s + p_1 p_2$$

$$p_1 + p_2 = l_2 - a_{11} - a_{22}$$

$$p_1 p_2 = a_{11}a_{22} - a_{11}l_2 - a_{21}a_{12} + a_{21}l_1$$

$$l_2 = p_1 + p_2 + a_{11} + a_{22}$$

$$l_1 = \frac{p_1 p_2 - a_{11}a_{22} + a_{11}l_2 + a_{21}a_{12}}{a_{21}}$$