

پاسخ تمرین سری دوم- بخش دوم فیلتر و سنتز مدار

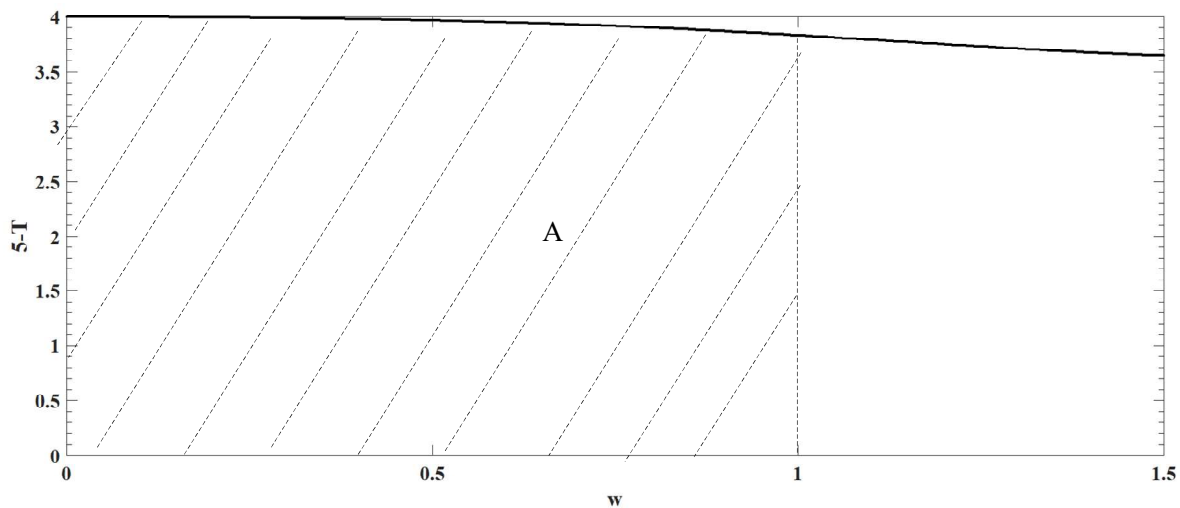
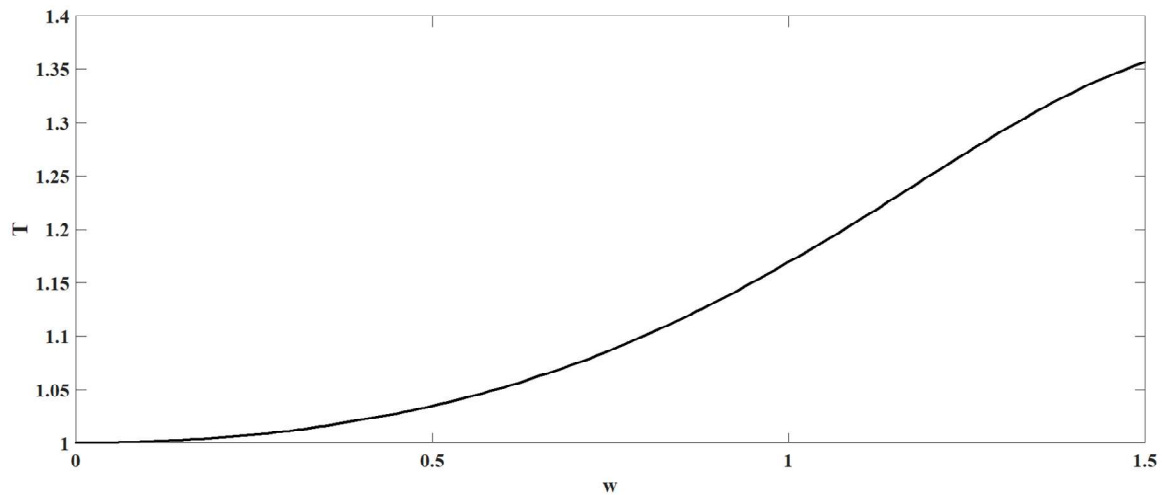
$$\alpha(1) = 1 \cdot \log(1 + \varepsilon') = 0.6733 \rightarrow \varepsilon' = 0.15624 = \frac{1}{64} \rightarrow \varepsilon = \frac{1}{\lambda} \Rightarrow R = \frac{1}{\sqrt[3]{\varepsilon}} = 2 \quad \text{۱- الف-}$$

$$p_k = -R \sin[(2k-1)\frac{\pi}{\varphi}] + jR \cos[(2k-1)\frac{\pi}{\varphi}] \rightarrow p_{1,2} = -1 \pm j\sqrt{3}, \quad p_3 = -2$$

$$F(s) = \frac{K}{(s+2)(s^2+2s+4)}, \quad K = \frac{1}{\varepsilon} = \lambda \rightarrow F(s) = \frac{\lambda}{(s+2)(s^2+2s+4)} \rightarrow F(s) = \frac{\lambda}{(j\omega+2)(-\omega^2+2j\omega+4)}$$

$$\beta = \tan^{-1}(0.5\omega) + \tan^{-1}\left(\frac{2\omega}{4-\omega^2}\right) \rightarrow T = \frac{0.5}{1+0.25\omega^2} + \frac{\frac{\lambda-2\omega^2+4\omega^2}{(4-\omega^2)^2}}{1+\left(\frac{2\omega}{4-\omega^2}\right)^2} = \frac{2}{\omega^2+4} + \frac{2\omega^2+\lambda}{\omega^4-4\omega^2+16} \rightarrow$$

$$T = \frac{4\omega^4 + \lambda\omega^2 + 8}{\omega^4 + 4}$$



$$A \simeq 3/\lambda \rightarrow N > \frac{A}{\pi} = 1/2 \Rightarrow N \geq 2 \rightarrow N_{\min} = 2$$

سطح A بات یک مستطیل تقریب زده شده است.

ب-

$$T_1(\omega) = \frac{2Q}{\omega} \frac{1 + (\frac{\omega}{\omega_0})^2}{1 + Q^2(\frac{\omega}{\omega_0} - \frac{\omega_0}{\omega})^2} \rightarrow T_1(\cdot) = \frac{2}{Q\omega_0} = 5 - T(\cdot) = 4 \rightarrow Q\omega_0 = 0.5$$

$$T_1(1) = \frac{2Q}{\omega_0} \frac{1 + \omega_0^2}{1 + Q^2(\omega_0 - \frac{1}{\omega_0})^2} = 5 - T(1) = 5 - \frac{76}{65} = \frac{249}{65} = 3.83 \rightarrow \frac{2Q\omega_0}{\omega_0^2} \frac{1 + \omega_0^2}{1 + Q^2\omega_0^2(1 - \frac{1}{\omega_0^2})^2} = 3.83$$

$$\frac{1}{\omega_0^2} \frac{\omega_0^2(1 + \omega_0^2)}{\omega_0^2 + 0.25(\omega_0^2 - 1)^2} = 3.83 \rightarrow 3.83[\omega_0^2 + 0.25(\omega_0^2 - 1)^2] = \omega_0^2(1 + \omega_0^2) \rightarrow$$

$$3.83/7875\omega_0^2 - 2/915\omega_0^2 + 0.9575 = 0$$

با یک درجه ۲ جواب ندارد. دو درجه یک بکار می بریم :

$$T_1(\omega) = \frac{\frac{2}{\sigma_1}}{1 + (\frac{\omega}{\sigma_1})^2} + \frac{\frac{2}{\sigma_2}}{1 + (\frac{\omega}{\sigma_2})^2} \rightarrow T_1(\cdot) = \frac{2}{\sigma_1} + \frac{2}{\sigma_2} = 5 - T(\cdot) = 4 \rightarrow 2\sigma_1\sigma_2 = \sigma_1 + \sigma_2 \quad \boxed{1}$$

$$T_1(1) = \frac{\frac{2}{\sigma_1}}{1 + (\frac{1}{\sigma_1})^2} + \frac{\frac{2}{\sigma_2}}{1 + (\frac{1}{\sigma_2})^2} = 5 - T(1) = 5 - \frac{76}{65} = \frac{249}{65} = 3.83 \rightarrow \frac{2\sigma_1}{\sigma_1^2 + 1} + \frac{2\sigma_2}{\sigma_2^2 + 1} = 3.83 \rightarrow$$

$$\frac{2\sigma_1(\sigma_2^2 + 1) + 2\sigma_2(\sigma_1^2 + 1)}{(\sigma_1^2 + 1)(\sigma_2^2 + 1)} = 3.83 \xrightarrow{\boxed{1}} \frac{(\sigma_1 + \sigma_2)^2 + 2(\sigma_1 + \sigma_2)}{0.25(\sigma_1 + \sigma_2)^2 + (\sigma_1 + \sigma_2)^2 - (\sigma_1 + \sigma_2) + 1} = 3.83 \rightarrow$$

$$3.83/7875(\sigma_1 + \sigma_2)^2 - 5/83(\sigma_1 + \sigma_2) + 3.83 = 0$$

با دو درجه یک هم جواب ندارد.

۲- تمرین ۴۰ از فصل ۲ کتاب طراحی شبکه های الکتریکی و الکترونیکی

الف-

$$\frac{M}{N} = \frac{1}{T_s} + \frac{1}{\frac{3}{T_s} + \frac{1}{\frac{5}{T_s}}} = \frac{15 + 6(T_s)^2}{15T_s + (T_s)^2} \rightarrow F(s) = \frac{K}{15 + 15Ts + 6(T_s)^2 + (T_s)^2}, \quad F(\cdot) = 1 \rightarrow K = 15$$

$$F(s) = \frac{15}{15 + 45s + 54s^2 + 27s^2} = \frac{5}{5 + 15s + 18s^2 + 9s^2}$$

ب-

$$F(s) = \frac{5(a + bs^2)}{5 + 15s + 18s^2 + 9s^2} \rightarrow |F_1|^2 = \frac{25(a - b\omega^2)^2}{(\omega^2 - 18\omega^2)^2 + (15\omega - 9\omega^2)^2} \stackrel{\omega=1}{=} 1 \rightarrow \frac{25a^2}{25} = \frac{25(-2ab)}{-(10 \times 18) + 15^2} = 1 \rightarrow$$

$$a = \pm 1 \rightarrow b = \mp 0.9 \Rightarrow F_1(s) = \frac{5(1 - 0.9s^2)}{5 + 15s + 18s^2 + 9s^2}$$