Sheet 4

Question (1)

Design a low-pass third-order maximally flat filter using only series stubs. The cutoff frequency is 6 GHz and the impedance is 50 Ω .

Optional: Use CAD to plot insertion loss versus frequency.

Question (2)

Design a low-pass fourth-order maximally flat filter using only shunt stubs. The cutoff frequency is 6 GHz and the impedance is 50 Ω .

Optional: Use CAD to plot insertion loss versus frequency.

Question (3)

Show that the π equivalent circuit for short length of transmission line leads to equivalent circuits, such that high impedance line is equivalent to series inductance and low impedance line is equivalent to shunt capacitance.

Question (4)

Design a stepped-impedance low-pass filter having a cutoff frequency of 3 GHz, and a fifth-order 0.5 dB equal-ripple response. Assume $R_0 = 50 \ \Omega$, $Z_{\ell} = 15 \ \Omega$, and $Z_h = 120 \ \Omega$. Find the required electrical lengths of the five sections.

- Optional:
 - (a) Use CAD to plot insertion loss from 0 to 6 GHz.
 - (b) Lay out of the microstrip implementation of the filter on an FR4 substrate having $\epsilon_r = 4.2$, d = 0.079 cm, $\tan \delta = 0.02$, with copper conductors 0.5 mil (Milli-inch) thick.
 - (c) Use CAD to plot the insertion loss versus frequency in the passband of the filter and compare with the lossless case.