EE 481/581 Microwave Engineering (Fall 2024)

Homework 4

Friday, September 20, 2024

1) For a circuit operating at 100 MHz, design and sketch a single series inductor matching network for a load $Z_L = 100 + j150\ \Omega$ connected to a lossless transmission line (250 Ω, 2×10^8 m/s). Use Smith chart solution method.
2) For a circuit operating at 2.5 GHz, design and sketch a single parallel capacitor matching network for a load $Z_L = 100 - j50\ \Omega$ connected to a lossless transmission line (25 Ω, 2×10^8 m/s). Use Smith chart solution method.
3) For a circuit operating at 2.5 GHz, design and sketch a lossless *L*-network using a parallel capacitor to match a load $Z_L = 100 - j50\ \Omega$ to a lossless transmission line (25 Ω, 2×10^8 m/s). Use Smith chart solution method. Confirm component values using analytic equations.
4) For a circuit operating at 125 MHz, design and sketch a lossless *L*-network using a series inductor match a load $Z_L = 150 + j120\ \Omega$ to a lossless transmission line (300 Ω, 2.8×10^8 m/s). Use Smith chart solution method. Confirm component values using analytic equations.
5) For problem 3), using the *L*-network designed, calculate the component impedances, input impedance (at terminals of matching network), input reflection coefficient, and SWR at 2.45, 2.5, & 2.55 GHz. Tabulate results. Format: col. 1 frequency, col. 2 Z_{cap}, col. 3 Z_{ind}, col. 4 Z_{in}, col. 4 Γ_{in}, & col. 5 SWR.
6) EE 581 only: For problem 1), using the designed match, calculate the match-point impedance, inductor impedance, input impedance (at terminals of matching network), input reflection coefficient, and SWR at 95, 100, & 105 MHz. Tabulate results. Format: col. 1 frequency, col. 2 Z_m, col. 3 Z_{ind}, col. 4 Z_{in}, col. 5 Γ_{in}, & col. 6 SWR.

Due Wednesday, September 25, 2024.

- Where relevant, one Smith chart per problem. **Clearly label** all work on Smith charts (e.g., label problem number, Z_0, f or λ, all points, arcs, distances, …).
- Put all complex quantities in phasor/polar form (e.g., $A\angle\theta°$) except admittances, impedances, and propagation constants which should be in rectangular form.