EE 481/581 Microwave Engineering (Fall 2024)
Homework 12
Tuesday, December 3, 2024

1) 8.13 a) Find and make fully-labeled sketch of low-pass filter prototype circuit (use form shown in Fig. 8.25b with Thevenin equivalent source). b) Use Richards' Transformation to implement low-pass filter prototype using stubs and draw fully-labeled sketch of resulting circuit. c) Add unit element to the lefthand side, sketch resulting circuit, apply Kuroda identity, & sketch resulting circuit. d) Add a unit element to the righthand side by load, sketch resulting circuit, apply Kuroda identity, & sketch resulting circuit. e) Add a unit element to the righthand side by load (again), sketch resulting circuit, apply Kuroda identity to each of the two resulting short-circuit stub & unit element combinations, and sketch resulting circuit. [Normalized design should now only have shunt open-circuit stubs.] f) Scale all impedances to a 50 Ω system and draw a fully-labeled sketch of final design. For all steps, the lengths ℓ may be left in terms of λ at f_c. CAD part is not required.

2) 8.16a First, find and draw fully-labeled sketch of low-pass filter prototype circuit (use form shown in Fig. 8.25a). Also, specify the impedance associated with each section. CAD part is not required.

3) Use MWI program to design a microstrip implementation of the stepped-impedance low-pass filter designed in 8.16a on Rogers RO4003C with 1 oz. copper and 0.06" board thickness. [Hint: Use 'Dk values for characteristic impedance' option.] a) Find width w_{15}, phase velocity w_{15}, wavelength λ_{15}, and length ℓ_{15} of 15 Ω sections. b) Find width w_{120}, phase velocity w_{120}, wavelength λ_{120}, and length ℓ_{120} of 120 Ω sections. c) Find width w_{50}, phase velocity w_{50}, and wavelength λ_{50} for 50 Ω microstrip. d) Draw a fully-labeled top view sketch of design with 50 Ω microstrip traces (indefinite length) at input and output. For legibility, the sketch may be scaled.

➢ Include any design figures/tables used.

Due Friday, December 6, 2024 by 4 pm at my office or EECS mail box.