JUAS 2019 – Computer Exercises

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Navigating in the Smith chart

These exercises are intended to be solved with the "Smith V4.1" tool by Fritz Dellsperger. It can be downloaded for free from: http://www.fritz.dellsperger.net/downloads.htm

1. Use R, L and C elements in series to match the impedances at 500 MHz to $Z_0 = 50\ \Omega$. Use only 2 components for each matching circuit.
   - You should enter Z_L as the first data point in the smith chart by clicking on the "Mouse" or "Keyboard" buttons at the top. Then design your matching circuit from there.
   - You will only need the Z-plane for this exercise; the Y-plane can be turned off in the program settings.

Z_L	C Series	L Series	R Series
Z = (50 + j25) Ω			
Z = (50 - j25) Ω			
Z = (4 + j21) Ω			
Z = (20 – j50) Ω			

2. Use R, L and C elements in parallel to match the impedances at 500 MHz to $Z_0 = 50\ \Omega$. Use only 2 components for each matching circuit.
   Hint: You will only need the Y-plane for this exercise

Z_L	C Shunt	L Shunt	R Shunt
Z = (50 + j25) Ω			
Z = (50 - j25) Ω			
Z = (4 + j21) Ω			
Z = (20 – j50) Ω			

3. Match the impedances at 500 MHz to $Z_0 = 50\ \Omega$. Use only 2 reactive components (in series or parallel) to create a lossless matching circuit.

Z_L	C Series	L Series	C Shunt	L Shunt
Z = (32 – j66) Ω				
Z = (13 – j9) Ω				
Z = (37 + j34) Ω				
Z = (78 + j78) Ω				

   Enter the C_{shunt} and L_{shunt} values from the LC circuit of the first exercise in the Smith chart and verify its resonant frequency.

4. The input impedance $Z_L = (17 – j18)\ \Omega$ of an amplifier shall be matched to $Z_0 = 50\ \Omega$ at 500 MHz. Use only two coaxial lines with the impedances of 50 Ω and 25 Ω in a series configuration. What is the electrical length of the two lines? (multiple solutions possible!)

Interesting Weblinks

http://www.microwaves101.com/	The basic concepts of microwave design theory. Very practical information for the RF engineer
http://www2.rohde-schwarz.com/en/service_and_support/Downloads/Application_Notes/	Application notes from Rhode & Schwarz
http://www.home.agilent.com/agilent/facet.jspx?t=79831.g.1&pageType=k&pageMode=TM&cc=CH&lc=ger&sm=g	Application notes from Agilent
http://www.anritsu.com/search/en-gb/downloadssearch.aspx?Id=D29%252fD1	Application notes from Anritsu
http://www.amanogawa.com/	Electrical engineering applets
http://www.ecalc.com/	Online scientific calculator
http://wcalc.sourceforge.net/cgi-wcalc.html	Calculate microstrip components online
http://www.falstad.com/mathphysics.html	Physics applets (3D waves, dispersion, antennas, etc.)
http://www.radartutorial.eu/index.en.html	This page provides a detailed overview of radar principles and technologies, including mathematical, physical and technical explanations. “Radartutorial” explains the fundamentals of radar
http://www.ece.rutgers.edu/~orfanidi/ewa/	Complete RF theory book online