

JUAS 2018 – Computer Exercises

F. Caspers, M. Wendt

Navigating in the Smith chart

These exercises are intended to be solved with the “Smith V4.0” tool by Fritz Dellsperger. It can be downloaded for free from: <http://www.fritz.dellsperger.net/downloads.htm>

- 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
$Z = (50 + j25) \Omega$			
$Z = (50 - j25) \Omega$			
$Z = (4 + j21) \Omega$			
$Z = (20 - j50) \Omega$			

- 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
$Z = (50 + j25) \Omega$			
$Z = (50 - j25) \Omega$			
$Z = (4 + j21) \Omega$			
$Z = (20 - j50) \Omega$			

- 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
$Z = (32 - j66) \Omega$				
$Z = (13 - j9) \Omega$				
$Z = (37 + j34) \Omega$				
$Z = (78 + j78) \Omega$				

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.

- 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 50Ω and 25Ω 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.jsp?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