

Erasmus+ E(rasmus) Mundus on Innovative Microwave Electronics and Optics



3. Smith Chart and impedance matching

1. Reflection coefficient calculations

Exercise #1: Analytical calculations versus Smith chart (tutorial n1 Smith chart.pptx)

An air line, with a characteristic impedance of $Z_C = 250 \Omega$, is powered at the frequency $f_0 = 500 \text{ MHz}$.

It is 2m long and ends at an impedance Z_L . The SWR along the line is s=5 and the first maximum voltage is at d=12 cm from the load.

- Calculate $|\rho_L|$, ρ_L module and argument of the reflection coefficient on the load.
- Calculate Z₁.
- The input voltage is 10V. What is the value of the voltage at the load terminals. Give V_{max} and V_{min} on the line.

Foundations of electromagnetic wave propagation

November 2021 - 127 -

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(2)

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Exercise #2: Graphical calculations on Smith chart (tutorial #2 Smith chart)

An air line, with a characteristic impedance of $Z_C = 20~\Omega$, is loaded at its end on an impedance $Z_L = R_L + j~X_L = (24 + j~36)~\Omega$. At the frequency of $f_0 = 3~\text{GHz}$, the length of the line is $\ell = \lambda_0/4$.

- 1) Give, using the Smith chart:
 - The reflection coefficient ρ_L , the SWR s_L on the load Z_L .
 - The reflection coefficient $\underline{\rho}_{in}$, the SWR s_{in} and the impedance Z_{in} at the distance ℓ , for f_0 = 3 GHz and f_1 = 4 GHz



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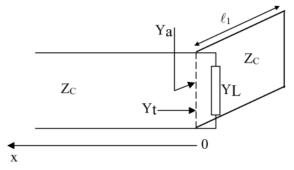
Exercise #2: Graphical calculations on Smith chart

2) A line of length ℓ_1 , with a characteristic impedance $Z_C = 20 \Omega$, short-circuited at one end, is placed in parallel on the previous load admittance $Y_L = 1 / Z_L$.

Let:

- Y_a the input admittance of this line with ℓ_1 length
- $Y_t = Y_a + Y_L$ the total admittance in x = 0

 ℓ_1 is selected to obtain a real Y_t named R_t . Use Smith chart to give ℓ_1 and R_t at f=3 GHz.



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November 2021 - 129

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