RLCG measurements (imitance) Ján Šaliga KEMT FEI TU Košice 2017

Real electronic components

- Real components are NOT ideal (perfect) . It they were ideal the would have only one physical property: resistivity, capacity or inductivity
- Real components have also parasitic properties
- We have strictly to distinguish components and their required physical properties: Resistor and resistivity Capacitor and capacity Coll (inductor) and inductivity





























What has influence on results?

- Condition of measurement and method of measurement:
 - Frequency of test signalAmplitude of test signal
 - Bias
 - Condition in environment (temperature, humidity, pressure, ...)
 - Component status (aging, mechanical
- deformation, ...)
 Fictive model for interpretation of results
- Errors and uncertainty of measurement



10













Measurement Technique Selection Criteria

- Frequency
- DUT Impedance
- Required measurement accuracy
- Electrical test conditions
- Measurement parameters
- Physical characteristics of the DUT

































Network Analysis

- Advantages and Disadvantages
- High frequency
 - Suitable for f > 100 kHz
 - Best for f > 1.8 GHz
- Moderate accuracy
- Limited impedance measurement range (DUT should be around 50 ohms)
- See more later within the special lecture on network
- analyzers











More connections

 Z_0

 $\mathbf{E}_{\mathbf{r}_2} = (1+\rho_1') \ \mathbf{E}_{\mathbf{r}_L} = (1+\rho_1') \ [\ \rho_2 \ (1+\rho_1) \ \mathbf{E}_i \]$

Z₀≠Z'₀≠ZL

 $[\rho_2 (1 + \rho_1) \mathbb{E}_1] = \mathbb{E}_{r_L}$

 $\mathbf{E}_{\mathbf{T}_2} - \mathbf{E}_{\mathbf{T}_2} = [\ \rho_2 \ (1-\rho_1 2 \) \]$ Ei

• a

o—

 $\rho_{1} = \frac{Z_{0} - Z_{0}}{Z_{0} + Z_{0}} = -\rho_{1}$ $\rho_{2} = \frac{Z_{L} - Z_{0}}{Z_{L} + Z_{0}}$

z₀>Z⁰₀<ZL

Er2

30

Ĕ; ↓







TDNA - time domain network analyzer (TDR)

- Advantages and Disadvantages
- Reflection and transmission measurements
- Single and multiple discontinuities or impedance mismatches ("Inside" look at devices)
- DUT impedance should be around 50 ohms
- Not accurate for $m\Omega$ or $M\Omega$ DUTs or DUTs with multiple reflections
- Good for test fixture design, transmission lines, high frequency evaluations