Università degli Studi di Firenze
Corso di Laurea in Ingegneria elettronica

Laboratorio di progettazione in alta frequenza

Docente: Iacopo Magrini

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Ricevimento: il giovedì dalle 15 alle 17 presso l'ufficio del prof. Gianfranco Manes, Dipartimento di Elettronica e Telecomunicazioni (DET), via di S.Marta 3.

Argomenti del corso

Parte Teorica

- Problema dell'adattamento
- Richiami sulle modulazioni digitali
- Descrizione delle moderne architetture di ricetrasmissione per applicazioni wireless

Laboratorio

- Matching di carichi passivi
- Progettazione di un signal detector
- Progettazione di un transceiver basato su di una modulazione FSK

Lezioni

- Lunedì dalle 17 alle 18.30 (teoria)
- ? Martedì dalle 10 alle 13 (Lab)

Svolgimento dell'esame

- Relazione sulle attività di laboratorio svolte
- Prova orale

Testi di riferimento: **RF Microelectronics**

Razavi

Università degli Studi di Firenze

Dipartimento di Elettronica e telecomunicazioni

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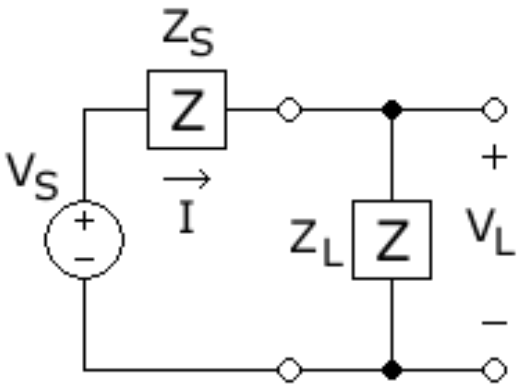
Appunti del corso "Circuiti a Microonde"

Searching the impedance matching



Target:

- maximum power transfer toward the load
- Minimum refelection to the source

$$|I| = \frac{|V_S|}{Z_S + Z_L}$$

$$P_L = I_{rms}^2 R_L = \frac{1}{2}|I|^2 R_L = \frac{1}{2}\left(\frac{|V_S|}{Z_S + Z_L}\right)^2 R_L$$

$$= \frac{1}{2}\frac{|V_S|^2 R_L}{(R_S + R_L)^2 + (X_S + X_L)^2}$$

Making minimum the denominator

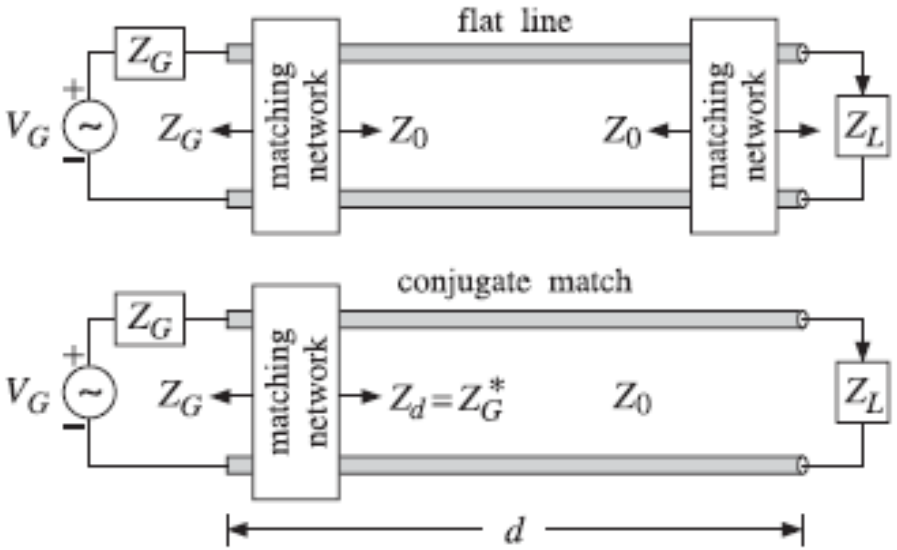
- $R_L = R_S$
- $X_L = -X_S$

can be concisely written with a complex conjugate as:

$$Z_S = Z_L^*$$

Searching the impedance matching

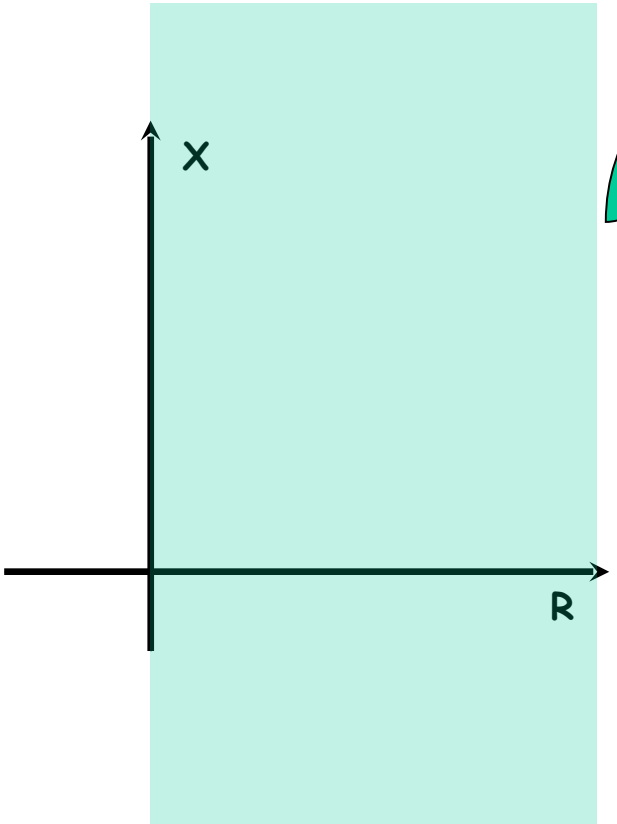
Conjugate Matching doesn't mean reflectionless matching

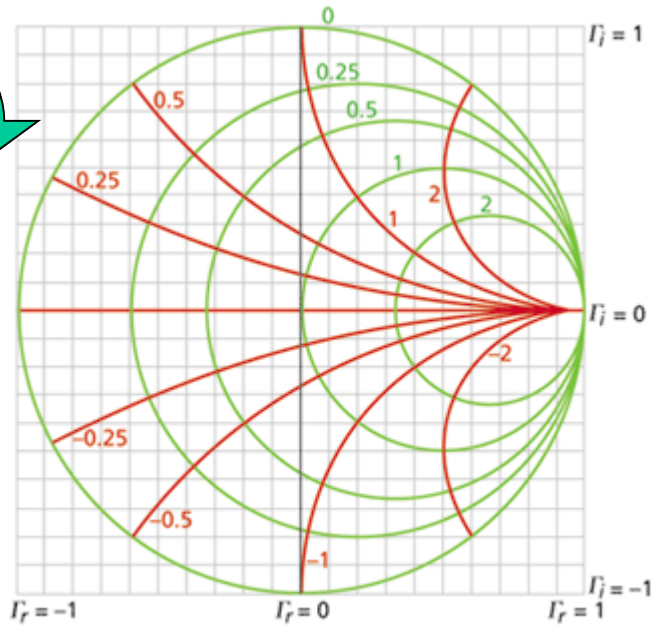


For High frequencies design S parameters and reflection coefficients are taken into account

Searching the impedance matching

The key tool for matching is the Smith Chart





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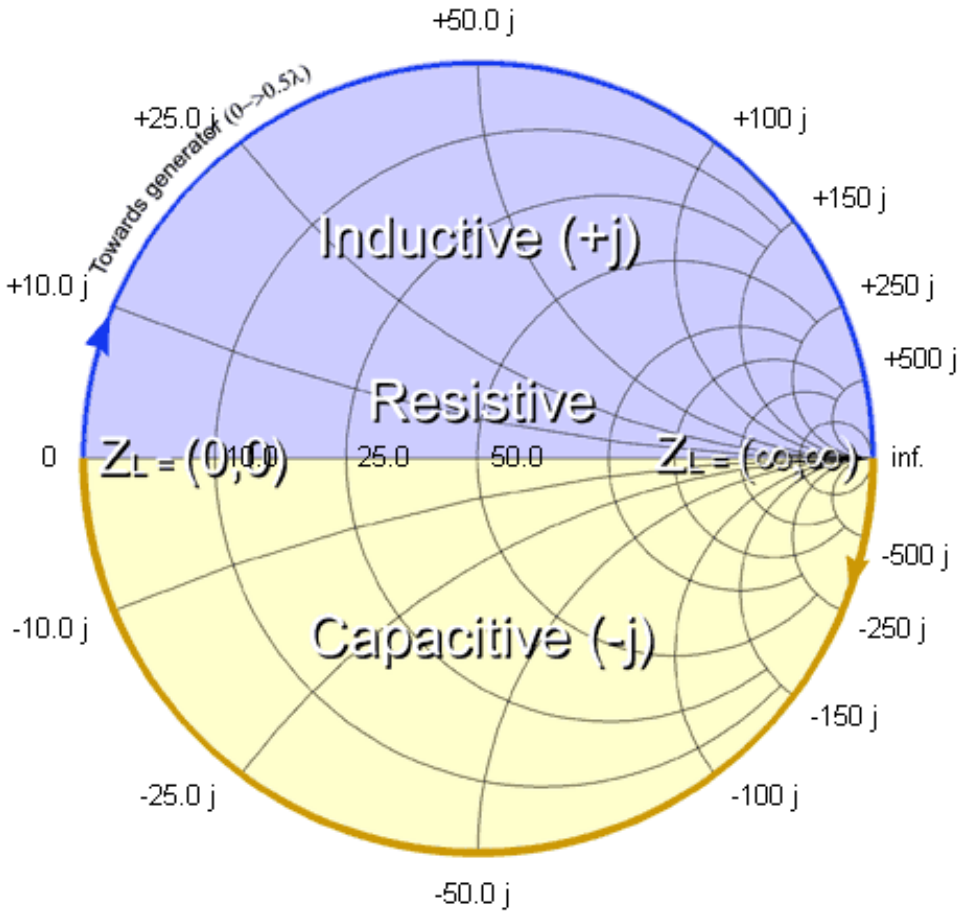

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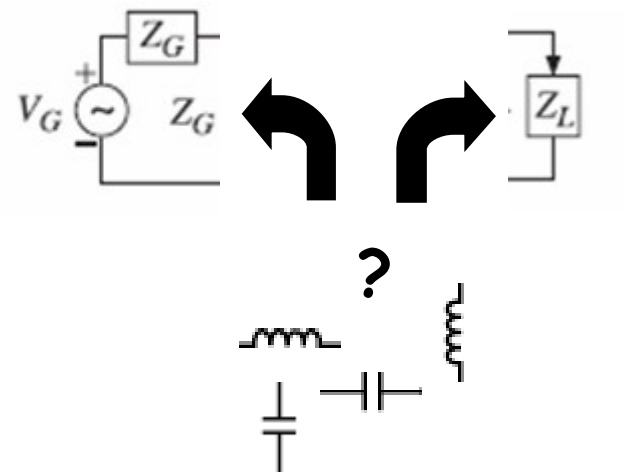
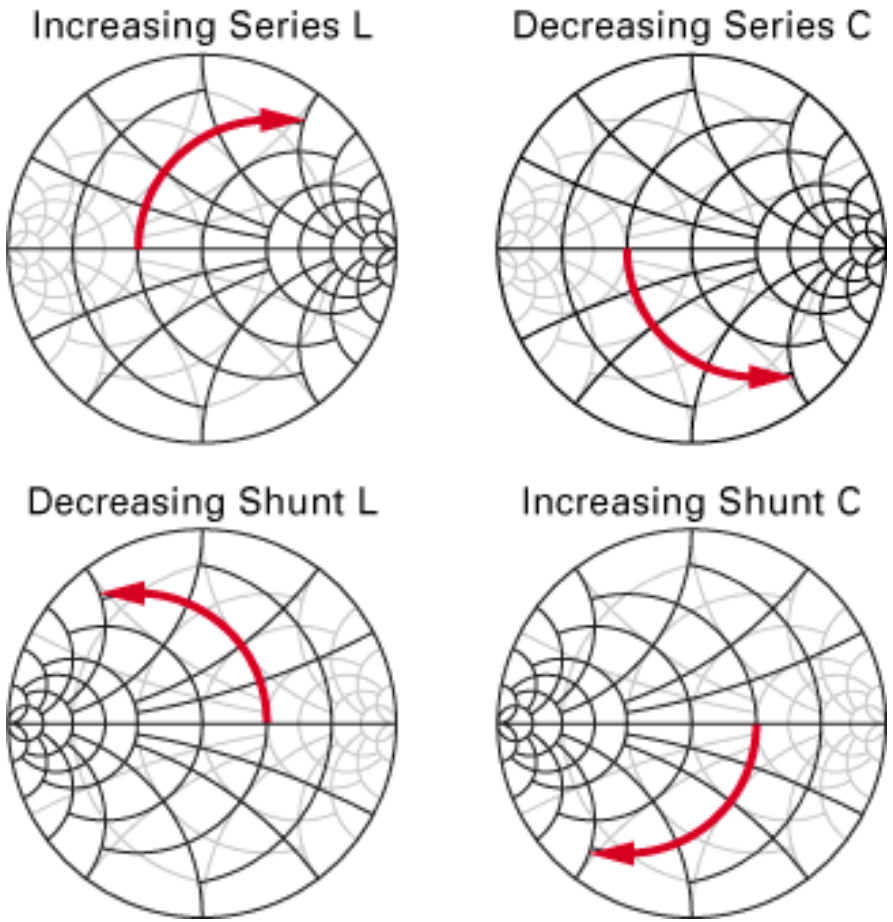
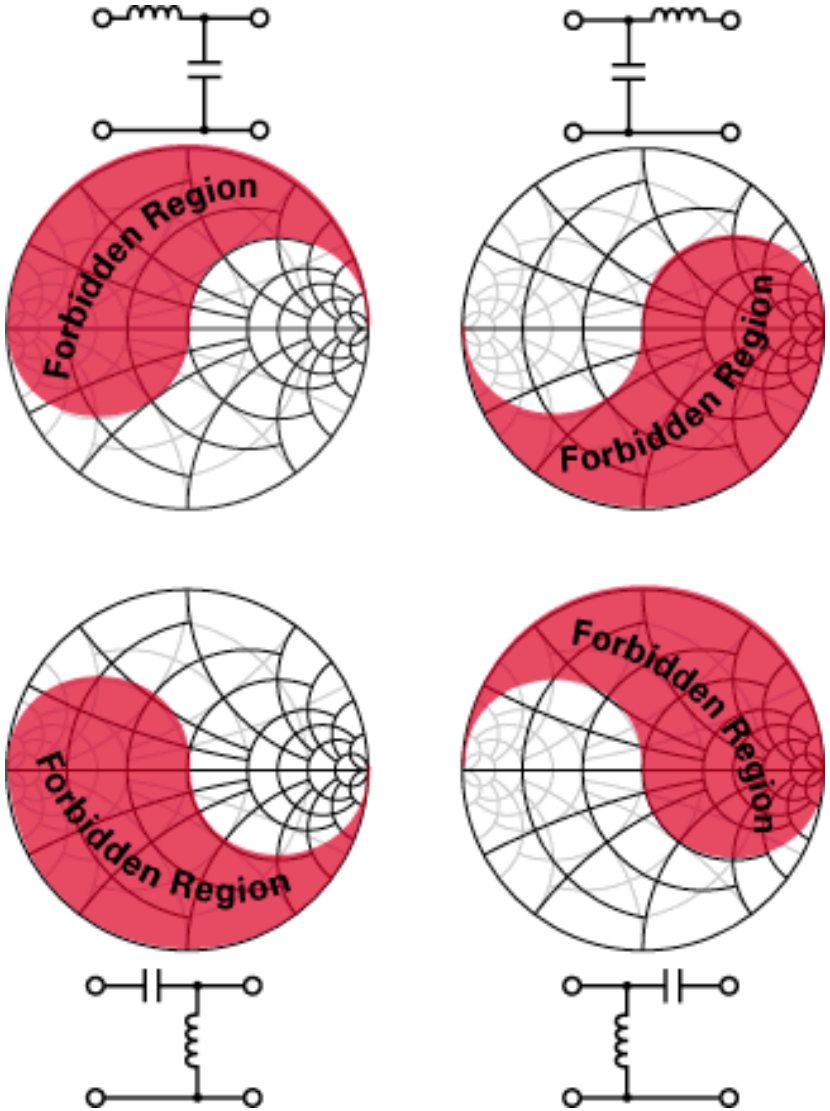


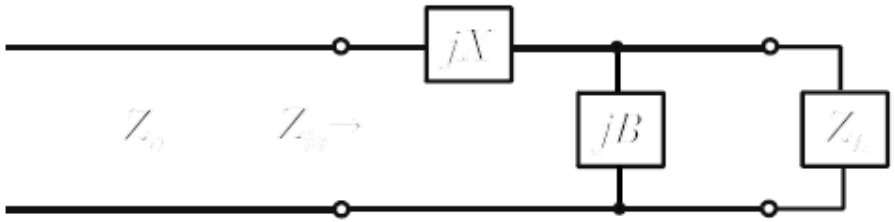


Searching the impedance matching

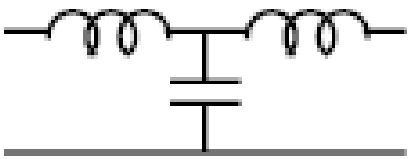


Searching the impedance matching

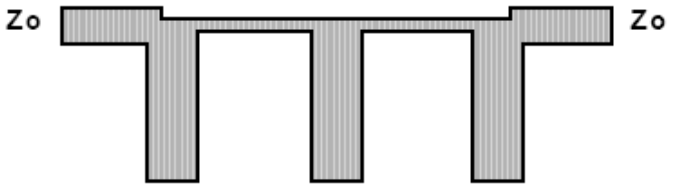
Which elements have to be used?



Lumped

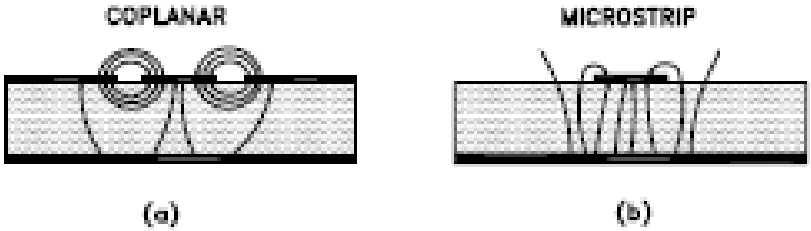


Distributed



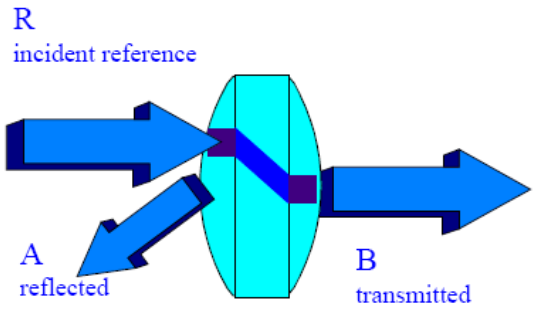
Searching the impedance matching

Also using lumped elemets a line for "bringing" the ignal is needed



Searching the impedance matching

S parameters are the "master" representation for microwaves



$$\begin{pmatrix} |b_1|^2 \\ |b_2|^2 \end{pmatrix} = \begin{pmatrix} |S_{11}|^2 & |S_{12}|^2 \\ |S_{21}|^2 & |S_{22}|^2 \end{pmatrix} * \begin{pmatrix} |a_1|^2 \\ |a_2|^2 \end{pmatrix}$$

$|a_i|^2$ power wave traveling towards the twoport gate

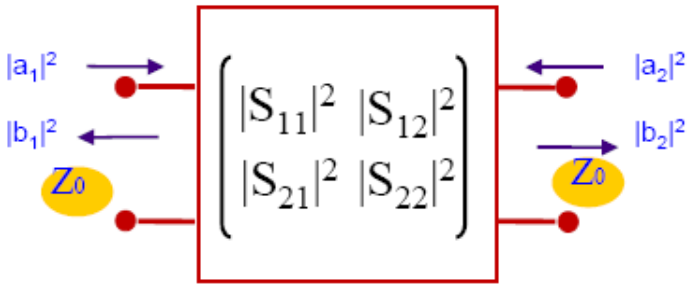
$|b_i|^2$ power wave reflected back from the twoport gate

$|S_{11}|^2$ power reflected from port1

$|S_{12}|^2$ power transmitted from port1 to port2

$|S_{21}|^2$ power transmitted from port2 to port1

$|S_{22}|^2$ power reflected from port2



$$b_1 = S_{11}a_1 + S_{12}a_2 = S_{11}a_1 \quad \Rightarrow \quad S_{11} = \left.\frac{b_1}{a_1}\right|_{Z_L = Z_0} = \text{reflection coefficient}$$

$$b_2 = S_{21}a_1 + S_{22}a_2 = S_{21}a_1 \quad \Rightarrow \quad S_{21} = \left.\frac{b_2}{a_1}\right|_{Z_L = Z_0} = \text{transmission coefficient}$$