matrice scattering 1/2

(onde di tensione)

$$V_1 = a_1 + b_1 \qquad I_1 = \frac{a_1 - b_1}{Z_0}$$

$$V_2 = a_2 + b_2 \qquad I_2 = \frac{a_2 - b_2}{Z_0}$$

$$b_1 = S_{11}a_1 + S_{12}a_2$$

$$b_2 = S_{21}a_1 + S_{22}a_2$$

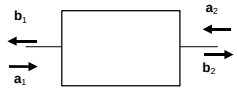
$$[b] = [S]\,[a]$$

$$S_{ij} = \left(\frac{b_i}{a_j}\right)_{a_k=0 \text{ con } k \neq j}$$

Nell'ipotesi che tutte le impedenze caratteristiche delle linee di accesso Z_{0i} siano uguali, valgono le seguenti proprietà:

per componenti reciproci $S_{ij} = S_{ji}$ che, in forma matriciale diventa: $[S] = [S]^T$
per componenti privi di perdite $[S]\,[S]^{T*} = [1]$
simmetria porte i,j $\Rightarrow S_{ij} = S_{ji}$

matrice scattering 2/2



$$P_1 = P_E = \frac{1}{2}\mathrm{Re}\left(V_1 I_1^*\right) = \frac{1}{2}\mathrm{Re}\left\{\left(a_1 + b_1\right)\left(\frac{a_1 - b_1}{Z_0}\right)^*\right\} = \frac{1}{2Z_0}|a_1|^2 - \frac{1}{2Z_0}|b_1|^2$$

$$P_1 = P_E = P_I - P_R = P_I\left(1 - \frac{P_R}{P_I}\right) = P_I\left(1 - |\Gamma_I|^2\right)$$

$$P_2 = \frac{1}{2}\mathrm{Re}\left(V_2 (-I_2)^*\right) = \frac{1}{2}\mathrm{Re}\left\{\left(a_2 + b_2\right)\left(\frac{b_2 - a_2}{Z_0}\right)^*\right\} = -\frac{1}{2Z_0}|a_2|^2 + \frac{1}{2Z_0}|b_2|^2$$

$$\text{se } a_2 = 0 \longrightarrow P_2 = P_O = \frac{1}{2Z_0}|b_2|^2 = \frac{1}{2Z_0}|S_{21}|^2|a_1|^2 = P_I|S_{21}|^2 \longrightarrow |S_{21}|^2 = \frac{P_O}{P_I}$$

$$\text{se } a_2 = 0 \longrightarrow |\Gamma_I| = |S_{11}| \longrightarrow |S_{11}|^2 = \frac{P_R}{P_I}$$

i moduli quadrati dei parametri di scattering sono rapporti tra potenze

Parametri reti 2 porte

$$A_{dB} = 10\log_{10}\frac{P_I}{P_O} = 10\log_{10}\frac{P_I}{P_E} + 10\log_{10}\frac{P_E}{P_O} = A_{RdB} + A_{DdB}$$

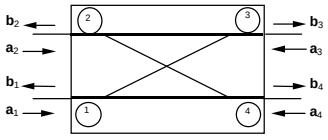
A_{dB} = Attenuazione

A_{RdB} = Attenuazione per riflessione

A_{DdB} = Attenuazione per dissipazione

$$L_{RdB} = 10\log_{10}\frac{P_I}{P_R}$$ L_{RdB} = Perdita di Riflessione

Parametri AD



Accoppiamento $C_{dB} = 10\log\frac{P_{31}}{P_I}$

Isolamento $I_{dB} = 10\log\frac{P_{21}}{P_I}$

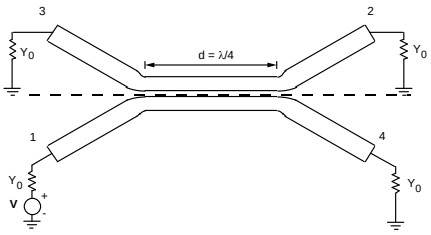
Direttività $D_{dB} = 10\log\frac{P_{31}}{P_{21}}$

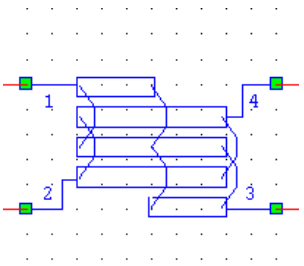
Con le porte chiuse su carichi adattati: $a_2 = 0$, $a_3 = 0$, $a_4 = 0$
e la porta 1 alimentata con un generatore adattato

$$C_{dB} = 10\log_{10}|S_{31}|^2 \qquad I_{dB} = 10\log_{10}|S_{21}|^2 \qquad D_{dB} = 10\log_{10}\frac{|S_{31}|^2}{|S_{21}|^2}$$

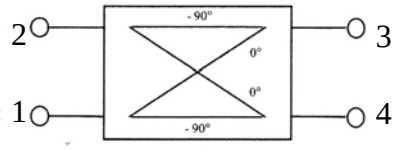
$D = P_{31}/P_{21} = (P_{31}/P_I)(P_I/P_{21}) = C/I$ $\quad D_{dB} = -I_{dB} + C_{dB}$

AD distribuiti



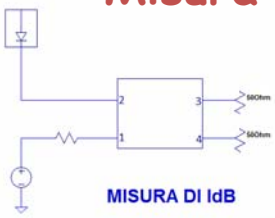


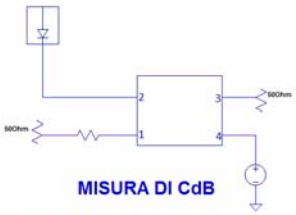
AD di Lange
Ibrido a 90°



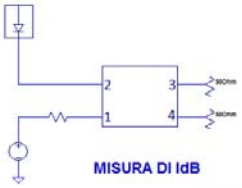
Ibrido => divisore di potenza
90°=>Fase(S13)-Fase(S14) = -90

Misura Direttività





DdB = -IdB + CdB



DdB = -IdB + CdB