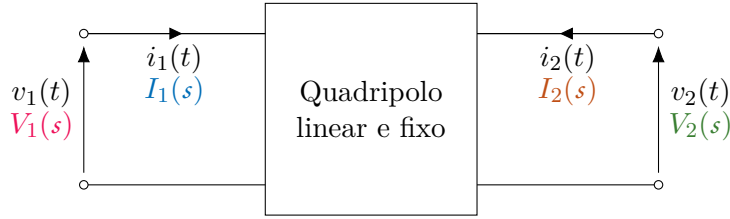


PSI3213: Circuitos Elétricos II

Parâmetros dos Quadripolos



	Equações dos terminais	Cálculo dos parâmetros		
MATRIZES DE IMITÂNCIA		Parâmetros z		
	$\mathbf{Z} = \begin{bmatrix} z_{11} & z_{12} \\ z_{21} & z_{22} \end{bmatrix}$	$\begin{cases} \textcolor{red}{V}_1 = z_{11}\textcolor{blue}{I}_1 + z_{12}\textcolor{brown}{I}_2 \\ \textcolor{green}{V}_2 = z_{21}\textcolor{blue}{I}_1 + z_{22}\textcolor{brown}{I}_2 \end{cases}$	$z_{11} = \left. \frac{\textcolor{red}{V}_1}{\textcolor{blue}{I}_1} \right _{\textcolor{brown}{I}_2=0}$ $z_{21} = \left. \frac{\textcolor{green}{V}_2}{\textcolor{blue}{I}_1} \right _{\textcolor{brown}{I}_2=0}$	$z_{12} = \left. \frac{\textcolor{red}{V}_1}{\textcolor{brown}{I}_2} \right _{\textcolor{blue}{I}_1=0}$ $z_{22} = \left. \frac{\textcolor{green}{V}_2}{\textcolor{brown}{I}_2} \right _{\textcolor{blue}{I}_1=0}$
	matriz de impedâncias			
	Parâmetros y			
MATRIZES DE ADMITÂNCIAS	$\mathbf{Y} = \begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix}$	$\begin{cases} \textcolor{blue}{I}_1 = y_{11}\textcolor{red}{V}_1 + y_{12}\textcolor{green}{V}_2 \\ \textcolor{brown}{I}_2 = y_{21}\textcolor{red}{V}_1 + y_{22}\textcolor{green}{V}_2 \end{cases}$	$y_{11} = \left. \frac{\textcolor{blue}{I}_1}{\textcolor{red}{V}_1} \right _{\textcolor{green}{V}_2=0}$ $y_{21} = \left. \frac{\textcolor{brown}{I}_2}{\textcolor{red}{V}_1} \right _{\textcolor{green}{V}_2=0}$	$y_{12} = \left. \frac{\textcolor{blue}{I}_1}{\textcolor{green}{V}_2} \right _{\textcolor{red}{V}_1=0}$ $y_{22} = \left. \frac{\textcolor{brown}{I}_2}{\textcolor{green}{V}_2} \right _{\textcolor{red}{V}_1=0}$
	matriz de admitâncias			
	Parâmetros h			
	MATRIZES HÍBRIDAS	$\mathbf{H} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix}$	$\begin{cases} \textcolor{red}{V}_1 = h_{11}\textcolor{blue}{I}_1 + h_{12}\textcolor{green}{V}_2 \\ \textcolor{brown}{I}_2 = h_{21}\textcolor{blue}{I}_1 + h_{22}\textcolor{green}{V}_2 \end{cases}$	$h_{11} = \left. \frac{\textcolor{red}{V}_1}{\textcolor{blue}{I}_1} \right _{\textcolor{green}{V}_2=0}$ $h_{21} = \left. \frac{\textcolor{brown}{I}_2}{\textcolor{blue}{I}_1} \right _{\textcolor{green}{V}_2=0}$
Parâmetros g				
MATRIZES DE TRANSMISSÃO		$\mathbf{G} = \begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{bmatrix}$	$\begin{cases} \textcolor{blue}{I}_1 = g_{11}\textcolor{red}{V}_1 + g_{12}\textcolor{brown}{I}_2 \\ \textcolor{green}{V}_2 = g_{21}\textcolor{red}{V}_1 + g_{22}\textcolor{brown}{I}_2 \end{cases}$	$g_{11} = \left. \frac{\textcolor{blue}{I}_1}{\textcolor{red}{V}_1} \right _{\textcolor{brown}{I}_2=0}$ $g_{21} = \left. \frac{\textcolor{green}{V}_2}{\textcolor{red}{V}_1} \right _{\textcolor{brown}{I}_2=0}$
	Parâmetros $ABCD$			
	MATRIZES DE TRANSMISSÃO	$\mathbf{T} = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$	$\begin{cases} \textcolor{red}{V}_1 = A\textcolor{green}{V}_2 + B(-\textcolor{brown}{I}_2) \\ \textcolor{blue}{I}_1 = C\textcolor{green}{V}_2 + D(-\textcolor{brown}{I}_2) \end{cases}$	$A = \left. \frac{\textcolor{red}{V}_1}{\textcolor{green}{V}_2} \right _{\textcolor{brown}{I}_2=0}$ $C = \left. \frac{\textcolor{blue}{I}_1}{\textcolor{green}{V}_2} \right _{\textcolor{brown}{I}_2=0}$
Parâmetros $ABCD$ inversos				
		$\mathbf{T}^{-1} = \begin{bmatrix} A' & B' \\ C' & D' \end{bmatrix}$	$\begin{cases} \textcolor{green}{V}_2 = A'\textcolor{red}{V}_1 + B'\textcolor{blue}{I}_1 \\ -\textcolor{brown}{I}_2 = C'\textcolor{red}{V}_1 + D'\textcolor{blue}{I}_1 \end{cases}$	$A' = \left. \frac{\textcolor{green}{V}_2}{\textcolor{red}{V}_1} \right _{\textcolor{blue}{I}_1=0}$ $C' = -\left. \frac{\textcolor{brown}{I}_2}{\textcolor{red}{V}_1} \right _{\textcolor{blue}{I}_1=0}$

Relações entre as Matrizes dos Quadripolos

	Z	Y	H	G	T	T⁻¹
Z	$\begin{bmatrix} z_{11} & z_{12} \\ z_{21} & z_{22} \end{bmatrix}$	$\begin{bmatrix} \frac{y_{22}}{ \mathbf{Y} } & -\frac{y_{12}}{ \mathbf{Y} } \\ -\frac{y_{21}}{ \mathbf{Y} } & \frac{y_{11}}{ \mathbf{Y} } \end{bmatrix}$	$\begin{bmatrix} \frac{ \mathbf{H} }{h_{22}} & \frac{h_{12}}{h_{22}} \\ -\frac{h_{21}}{h_{22}} & \frac{1}{h_{22}} \end{bmatrix}$	$\begin{bmatrix} \frac{1}{g_{11}} & -\frac{g_{12}}{g_{11}} \\ \frac{g_{21}}{g_{11}} & \frac{ \mathbf{G} }{g_{11}} \end{bmatrix}$	$\begin{bmatrix} \frac{A}{C} & \frac{ \mathbf{T} }{C} \\ \frac{1}{C} & \frac{D}{C} \end{bmatrix}$	$\begin{bmatrix} -\frac{D'}{C'} & -\frac{1}{C'} \\ -\frac{ \mathbf{T}^{-1} }{C'} & -\frac{A'}{C'} \end{bmatrix}$
Y	$\begin{bmatrix} \frac{z_{22}}{ \mathbf{Z} } & -\frac{z_{12}}{ \mathbf{Z} } \\ -\frac{z_{21}}{ \mathbf{Z} } & \frac{z_{11}}{ \mathbf{Z} } \end{bmatrix}$	$\begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix}$	$\begin{bmatrix} \frac{1}{h_{11}} & -\frac{h_{12}}{h_{11}} \\ \frac{h_{21}}{h_{11}} & \frac{ \mathbf{H} }{h_{11}} \end{bmatrix}$	$\begin{bmatrix} \frac{ \mathbf{G} }{g_{22}} & \frac{g_{12}}{g_{22}} \\ -\frac{g_{21}}{g_{22}} & \frac{1}{g_{22}} \end{bmatrix}$	$\begin{bmatrix} \frac{D}{B} & -\frac{ \mathbf{T} }{B} \\ -\frac{1}{B} & \frac{A}{B} \end{bmatrix}$	$\begin{bmatrix} -\frac{A'}{B'} & \frac{1}{B'} \\ \frac{ \mathbf{T}^{-1} }{B'} & -\frac{D'}{B'} \end{bmatrix}$
H	$\begin{bmatrix} \frac{ \mathbf{Z} }{z_{22}} & \frac{z_{12}}{z_{22}} \\ -\frac{z_{21}}{z_{22}} & \frac{1}{z_{22}} \end{bmatrix}$	$\begin{bmatrix} \frac{1}{y_{11}} & -\frac{y_{12}}{y_{11}} \\ \frac{y_{21}}{y_{11}} & \frac{ \mathbf{Y} }{y_{11}} \end{bmatrix}$	$\begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix}$	$\begin{bmatrix} \frac{g_{22}}{ \mathbf{G} } & -\frac{g_{12}}{ \mathbf{G} } \\ -\frac{g_{21}}{ \mathbf{G} } & \frac{g_{11}}{ \mathbf{G} } \end{bmatrix}$	$\begin{bmatrix} \frac{B}{D} & \frac{ \mathbf{T} }{D} \\ -\frac{1}{D} & \frac{C}{D} \end{bmatrix}$	$\begin{bmatrix} -\frac{B'}{A'} & \frac{1}{A'} \\ -\frac{ \mathbf{T}^{-1} }{A'} & -\frac{C'}{A'} \end{bmatrix}$
G	$\begin{bmatrix} \frac{1}{z_{11}} & -\frac{z_{12}}{z_{11}} \\ \frac{z_{21}}{z_{11}} & \frac{ \mathbf{Z} }{z_{11}} \end{bmatrix}$	$\begin{bmatrix} \frac{ \mathbf{Y} }{y_{22}} & \frac{y_{12}}{y_{22}} \\ -\frac{y_{21}}{y_{22}} & \frac{1}{y_{22}} \end{bmatrix}$	$\begin{bmatrix} \frac{h_{22}}{ \mathbf{H} } & -\frac{h_{12}}{ \mathbf{H} } \\ -\frac{h_{21}}{ \mathbf{H} } & \frac{h_{11}}{ \mathbf{H} } \end{bmatrix}$	$\begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{bmatrix}$	$\begin{bmatrix} \frac{C}{A} & -\frac{ \mathbf{T} }{A} \\ \frac{1}{A} & \frac{B}{A} \end{bmatrix}$	$\begin{bmatrix} -\frac{C'}{D'} & -\frac{1}{D'} \\ \frac{ \mathbf{T}^{-1} }{D'} & -\frac{B'}{D'} \end{bmatrix}$
T	$\begin{bmatrix} \frac{z_{11}}{z_{21}} & \frac{ \mathbf{Z} }{z_{21}} \\ \frac{z_{21}}{z_{21}} & \frac{z_{22}}{z_{21}} \\ \frac{1}{z_{21}} & \frac{z_{22}}{z_{21}} \end{bmatrix}$	$\begin{bmatrix} -\frac{y_{22}}{y_{21}} & -\frac{1}{y_{21}} \\ \frac{ \mathbf{Y} }{y_{21}} & -\frac{y_{11}}{y_{21}} \\ -\frac{y_{21}}{y_{21}} & -\frac{y_{11}}{y_{21}} \end{bmatrix}$	$\begin{bmatrix} -\frac{ \mathbf{H} }{h_{21}} & -\frac{h_{11}}{h_{21}} \\ \frac{h_{22}}{h_{21}} & -\frac{1}{h_{21}} \\ -\frac{h_{21}}{h_{21}} & -\frac{h_{21}}{h_{21}} \end{bmatrix}$	$\begin{bmatrix} \frac{1}{g_{21}} & \frac{g_{22}}{g_{21}} \\ \frac{g_{21}}{g_{21}} & \frac{ \mathbf{G} }{g_{21}} \\ \frac{g_{11}}{g_{21}} & \frac{ \mathbf{G} }{g_{21}} \end{bmatrix}$	$\begin{bmatrix} A & B \\ C & D \end{bmatrix}$	$\begin{bmatrix} \frac{D'}{ \mathbf{T}^{-1} } & -\frac{B'}{ \mathbf{T}^{-1} } \\ -\frac{C'}{ \mathbf{T}^{-1} } & \frac{A'}{ \mathbf{T}^{-1} } \\ -\frac{ \mathbf{T}^{-1} }{ \mathbf{T}^{-1} } & \frac{ \mathbf{T}^{-1} }{ \mathbf{T}^{-1} } \end{bmatrix}$
T⁻¹	$\begin{bmatrix} \frac{z_{22}}{z_{12}} & -\frac{ \mathbf{Z} }{z_{12}} \\ \frac{z_{12}}{z_{12}} & \frac{z_{11}}{z_{12}} \\ -\frac{1}{z_{12}} & \frac{z_{11}}{z_{12}} \end{bmatrix}$	$\begin{bmatrix} -\frac{y_{11}}{y_{12}} & \frac{1}{y_{12}} \\ \frac{ \mathbf{Y} }{y_{12}} & -\frac{y_{22}}{y_{12}} \\ \frac{y_{12}}{y_{12}} & \frac{y_{12}}{y_{12}} \end{bmatrix}$	$\begin{bmatrix} \frac{1}{h_{12}} & -\frac{h_{11}}{h_{12}} \\ \frac{h_{22}}{h_{12}} & \frac{ \mathbf{H} }{h_{12}} \\ -\frac{h_{12}}{h_{12}} & \frac{h_{12}}{h_{12}} \end{bmatrix}$	$\begin{bmatrix} -\frac{ \mathbf{G} }{g_{12}} & \frac{1}{g_{12}} \\ \frac{g_{11}}{g_{12}} & -\frac{1}{g_{12}} \\ \frac{g_{12}}{g_{12}} & \frac{ \mathbf{G} }{g_{12}} \end{bmatrix}$	$\begin{bmatrix} \frac{D}{ \mathbf{T} } & -\frac{B}{ \mathbf{T} } \\ -\frac{C}{ \mathbf{T} } & \frac{A}{ \mathbf{T} } \\ -\frac{ \mathbf{T} }{ \mathbf{T} } & \frac{ \mathbf{T} }{ \mathbf{T} } \end{bmatrix}$	$\begin{bmatrix} A' & B' \\ C' & D' \end{bmatrix}$

Nota: o símbolo $|\mathbf{M}|$ indica o determinante da matriz $\mathbf{M}$.