$$\begin{bmatrix} 0 & 2/1 & 2/1 \\ 2/1 & 0 & 2/1 \\ 2/1 & 2/1 & 0 \end{bmatrix} = [5]$$

2.2.1

$$\begin{bmatrix} 1/2 & 1/2 & 2/1 \\ 1/2 & 1/2 & 2/1 \\ 2/1 & 2/1 & 0 \end{bmatrix} = [5]$$

1.2.1

$$\begin{bmatrix} 1 & -1 & -1/2 \\ -1 & 1 & -1/2 \\ -1/2 & -1/2 & 0 \end{bmatrix} \frac{2}{1} = [5]$$

1.1.2

$$\begin{bmatrix} -1 & 1 & -1/2 \\ 1 & -1 & -1/2 \\ -1/2 & -1/2 & 0 \end{bmatrix} \frac{2}{1} = [5]$$

1.1.1

1.3.1

$$[\bar{S}] = \frac{-i}{\sqrt{2}} \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

1.4.1

$$[S] = \frac{1}{\sqrt{2}} \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & -1 \\ 1 & 1 & 0 & 0 \\ 1 & -1 & 0 & 0 \end{bmatrix}$$

1.4.2

$$[S] = \frac{1}{\sqrt{2}} \begin{bmatrix} 0 & 0 & 1 & -i \\ 0 & 0 & -i & 1 \\ 1 & -i & 0 & 0 \\ -i & 1 & 0 & 0 \end{bmatrix}$$

2.2

$$S_{11} = 0'9_{\angle -55^\circ} = 0'516 - 0'737j$$

$$S_{12} = 0'03_{\angle -60^\circ} = 0'015 - 0'026j$$

$$S_{21} = 3_{\angle 125^\circ} = -1'72 + 2'457j$$

$$S_{22} = 0'7_{\angle -30^\circ} = 0'606 - 0'35j$$

$$|A| = |S_{11}S_{22} - S_{21}S_{12}| = |0'055 - 0'627j - (0'038 + 0'082j)| =$$

$$= |0'017 - 0'709j| = \begin{cases} r = 0'709 \\ \theta = -88'65^\circ \end{cases}$$

$$|A| = 0'709 < 1 \quad OK$$

$$K = \frac{1 - |S_{11}|^2 - |S_{22}|^2 + |A|^2}{2|S_{21} \cdot S_{12}|} = \frac{1 - 0'9^2 - 0'7^2 + 0'709^2}{2|0'038 + 0'082j|} =$$

$$= \frac{1 - 0'81 - 0'49 + 0'502}{2 \cdot 9'04 \cdot 10^{-2}} = 1'117$$

$$K = 1'117 > 1 \quad OK$$

INCONDICIONALMENTE ESTABLE

$$|A| < 1$$

$$K > 1$$

2.3

$S_{11} = 0'75\angle 180° = -0'75$

$S_{12} = 0'04\angle 45° = 0'028 + 0'028j$

$S_{21} = 3\angle 75° = 0'776 + 2'898j$

$S_{22} = 0'4\angle -40° = 0'306 - 0'257j$

$|\Delta| = |S_{11}S_{22} - S_{21}S_{12}| = |-0'2295 + 0'193j - (-0'059 + 0'103j)| =$

$= |-0'17 + 0'09j| = \begin{cases} r = 0'192 \\ \theta = 152'1° \end{cases}$

$|\Delta| = 0'192 < 1 \quad OK$

$K = \dfrac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2 \cdot |S_{21}S_{12}|} = \dfrac{1 - 0'75^{-2} - 0'4^2 + 0'192^2}{2 \cdot |-0'059 - 0'103j|} =$

$= \dfrac{1 - 0'5625 - 0'16 + 0'0369}{2 \cdot 0'119} = 1'32$

$K = 1'32 > 1 \quad OK$

INCONDICIONALMENTE ESTABLE

$|\Delta| < 1$

$K > 1$

2.1

$S_{11} = 0'6 \angle -90° = 0 - 0'6j$

$S_{12} = 0'06 \angle -50° = 0'039 - 0'046j$

$S_{21} = 2'5 \angle 75° = 0'647 + 2'415j$

$S_{22} = 0'6 \angle -60° = 0'3 - 0'52j$

$|\Delta| = |S_{11}S_{22} - S_{21}S_{12}| = |-0'312 - 0'78j - (0'136 + 0'064j)| =$

$= |-0'448 - 0'244j| \left\{ \begin{array}{l} r = 0'51 \\ \theta = -151'4° \end{array} \right.$

$|\Delta| = 0'51 < 1$ O.K

$K = \dfrac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2|S_{21}S_{12}|} = \dfrac{1 - 0'6^2 - 0'6^2 + 0'51^2}{2|0'136 + 0'064j|} =$

$= \dfrac{1 - 0'36 - 0'36 + 0'2601}{2 \cdot 0'15} = 1'8$

$K = 1'8 > 1$ OK

INCONDICIONALMENTE ESTABLE

$|\Delta| < 1$

Y

$K > 1$