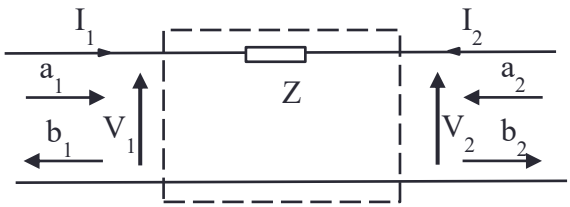
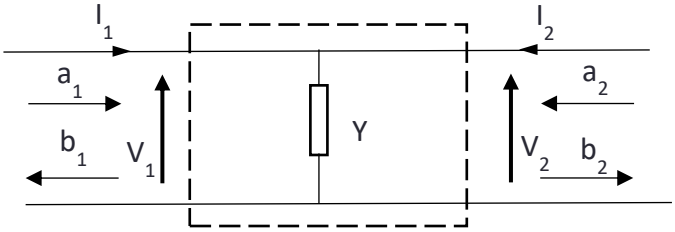
Tutorial on S parameters – Issue 1

Exercise #1 : S matrix of a serial impedance



From Kirchoff's and Ohm's laws and the expressions of power voltage-current waves as a function of the normalized voltage and current, give the S matrix of the serial impedance Z .

Exercise #2 : S matrix of a shunt admittance



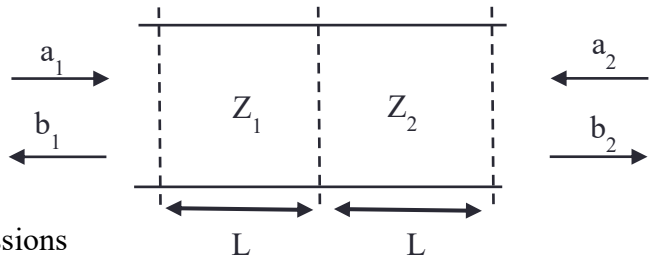
as previously, demonstrate that the S matrix for a shunt admittance could be written as:

$$[S] = \begin{bmatrix} -\frac{y_n}{y_n+2} & \frac{2}{y_n+2} \\ \frac{2}{y_n+2} & -\frac{y_n}{y_n+2} \end{bmatrix} \qquad \text{where } y_n = \frac{Y}{Y_0} \text{ and } Y_0 = \frac{1}{Z_0}$$

Exercise #3 : S matrix of impedance step

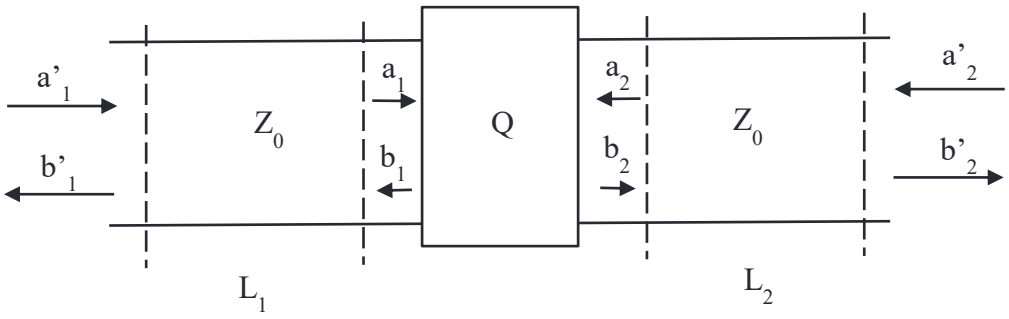
The matrix S is normalized with respect to:

- Z_1 at port 1
- Z_2 at port 2



From Kirchoff's and Ohm's laws and the expressions of power voltage-current waves as a function of the normalized voltage and current, give the S matrix of this diagram

Exercise #4 : S matrix of a quadripole connected to 2 transmission line



The S matrix of the quadripole Q, normalized with respect to Z_0, is assumed to be known. The connection lines are assumed to be lossless, with characteristic impedance Z_0.

Give the S matrix of this diagram.