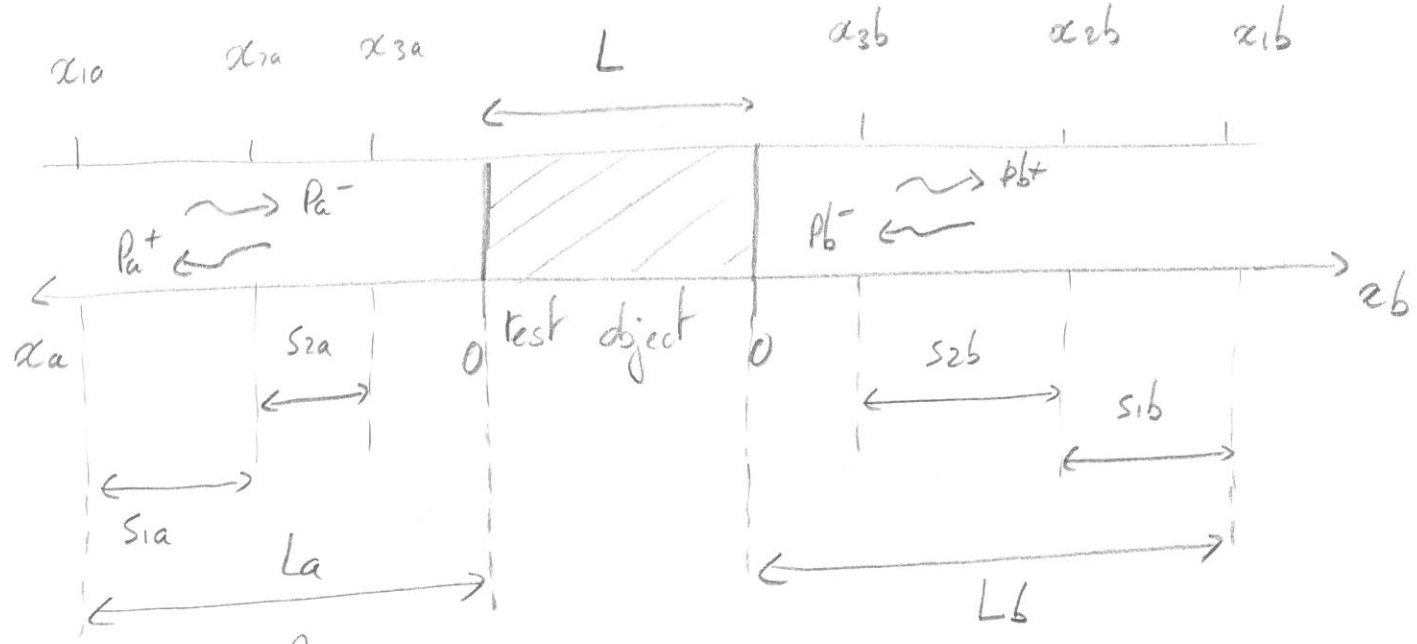
Kundt tube, scattering matrix measurements



$$p_a = p_{a+}\, e^{-ikx} + p_a^- \, e^{ikx}$$

$$\Rightarrow \begin{bmatrix} p_{a1} \\ p_{a2} \\ p_{a3} \end{bmatrix} = \underbrace{\begin{bmatrix} e^{-ikx_{1a}} & e^{ikx_{1a}} \\ e^{-ikx_{2a}} & e^{ikx_{2a}} \\ e^{-ikx_{3a}} & e^{ikx_{3a}} \end{bmatrix}}_{D_a} \begin{bmatrix} p_a^+ \\ p_a^- \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} p_a^+ \\ p_a^- \end{bmatrix} = D_a^{-1} \begin{bmatrix} p_{a1} \\ p_{a2} \\ p_{a3} \end{bmatrix}$$

(pseudo inverse if more than 2 mics)

$$\begin{bmatrix} p_b^+ \\ p_b^- \end{bmatrix} = D_b^{-1} \begin{bmatrix} p_{b1} \\ p_{b2} \\ p_{b3} \end{bmatrix}$$

Perform at least 2 measurements, with changing boundary conditions:

$$\underbrace{\begin{bmatrix} P_{a\,I}^{+} & P_{a\,II}^{+} & P_{a\,III}^{+} \\ P_{b\,I}^{+} & P_{b\,II}^{+} & P_{b\,III}^{+} \end{bmatrix}}_{P_+} = S \underbrace{\begin{bmatrix} P_{a\,I}^{-} & P_{a\,II}^{-} & P_{a\,III}^{-} \\ P_{b\,I}^{-} & P_{b\,II}^{-} & P_{b\,III}^{-} \end{bmatrix}}_{P_-}$$

$$\boxed{S = P_+ (P_-)^{-1}}$$

(pseudo inverse if more than 2 test cases)