



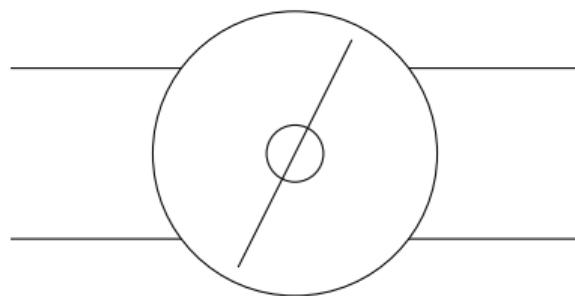
MAD exercise session 1

Least Squares

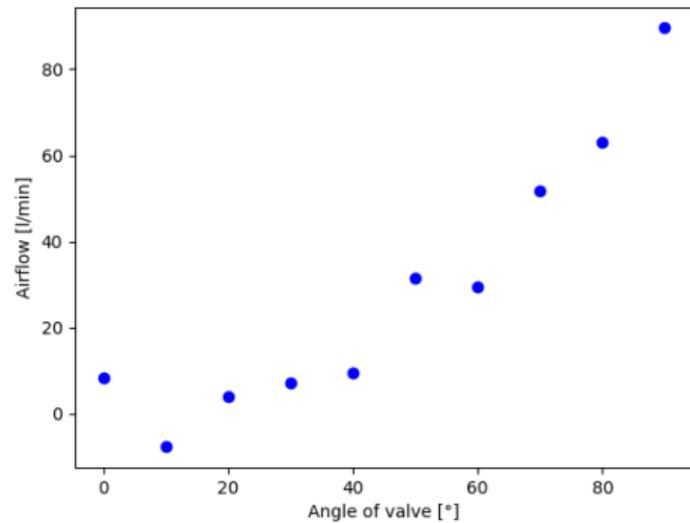
Pascal Auf der Maur

Problem

We have taken measurements of an airflow through a valve. We are now asked to find a function that describes the relation between the position of the valve and the flowrate.



Our measurements



Procedure

1. We choose a function that should approximate our measurements:

$$f(x) = ax + b$$

2. We optimize the parameters a and b to minimize a cost function

Our cost function is the squared error: $E^2 = (Aw - y)^2$ where

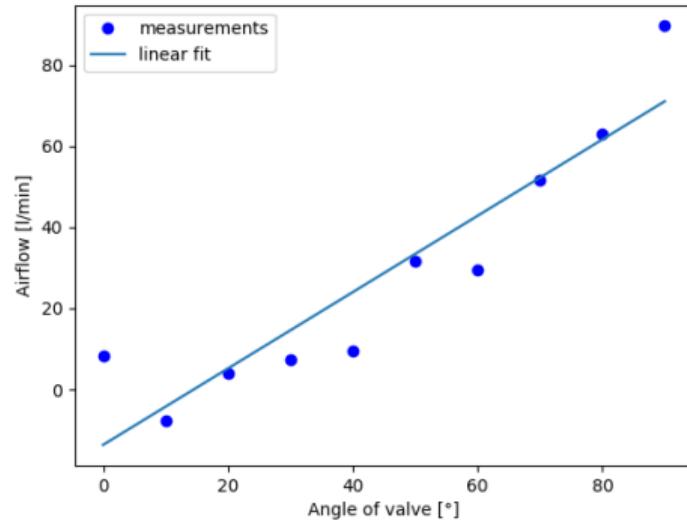
$$A = \begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ \vdots & \vdots \\ 1 & x_n \end{bmatrix} \quad w = \begin{bmatrix} b \\ a \end{bmatrix} \quad y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}$$

Result

The result of the minimisation problem is:

$$w = (A^T A)^{-1} A^T y$$

Result



Result

