

Assignment 10

➡ **Read the assignment carefully! Remember that the first line of a script must be the call to the script preamble.**

Write a MATLAB script with the name `Assignment10_IDxx.m`¹ that performs data reconciliation² in the context of material flow analysis. Figure 1 shows a small model with three flows and one process.

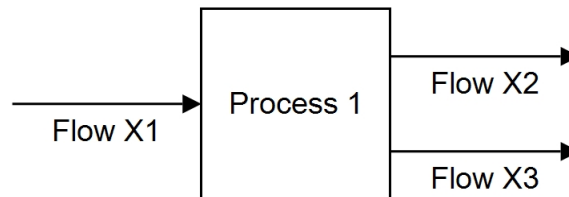


Figure 1: Flowsheet with three flows and one process.

Each flow i ($i = 1, 2, 3$) is represented by three variables: the mass flow g_i of a good, the mass flow s_i of a certain substance, and the concentration c_i of this substance within the good. The nine variables have to fulfill five constraints, namely the mass balances of the process with respect to g and s , and the three equations of the concentration in each flow:

$$g_1 = g_2 + g_3, \quad s_1 = s_2 + s_3, \quad s_1 = g_1 c_1, \quad s_2 = g_2 c_2, \quad s_3 = g_3 c_3.$$

Load the vector \mathbf{m} and the matrix \mathbf{V} from the file `flowdata.mat`. \mathbf{m} contains the measured values of the nine variables $[g_1, g_2, g_3, c_1, c_2, c_3, s_1, s_2, s_3]$, and \mathbf{V} is the corresponding error or covariance matrix. Compute the reconciled values \mathbf{x} of the variables in \mathbf{m} by constrained minimization of the quadratic form $Q(\mathbf{x})$ given by:

$$Q(\mathbf{x}) = (\mathbf{m} - \mathbf{x}) \cdot \mathbf{V}^{-1} \cdot (\mathbf{m} - \mathbf{x})^T.$$

Display the measured and the reconciled values in the command window, as well as the value of $Q(\mathbf{x})$ at the minimum **in an easily readable format or as a table**. (4 pt)

➡ Use `fmincon` with the following options:

`opts=optimoptions('fmincon','display','final','Algorithm','sqp')`

Algorithm `sqp` implements Sequential Quadratic Programming.³

➡ **Make sure that the relevant results and *only* those are shown in the output to the command window. Submit the script until 5pm on June 16, 2021. Don't forget to put your partner in cc! Any violation of the naming convention will lead to the rejection of the submission.**

¹ `xx` is your (group's) ID number

² "Ausgleichsrechnung" in German

³ https://en.wikipedia.org/wiki/Sequential_quadratic_programming