

**Material Flow Analysis
with Software STAN**

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Software for Substance Flow Analysis

STAN

Vienna University of Technology

Funded by: Lebensministerium - Federal States of Austria - vomat/afpa
Published by: Institute for Water Quality, Resources and Waste Management
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download: www.iwa.tuwien.ac.at

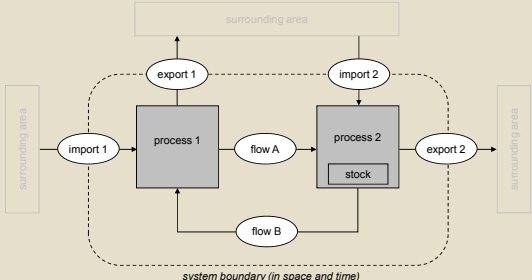
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Definition Material Flow Analysis (MFA)

Material Flow Analysis (MFA) is a tool for describing and analysing complex systems with respect to goods and substances.

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Build-up of MFA models (1)



surrounding area

import 1

process 1

flow A

process 2

stock

export 2

flow B

export 1

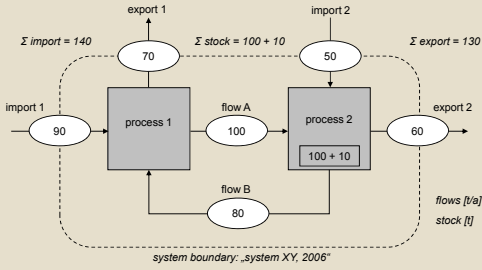
import 2

surrounding area

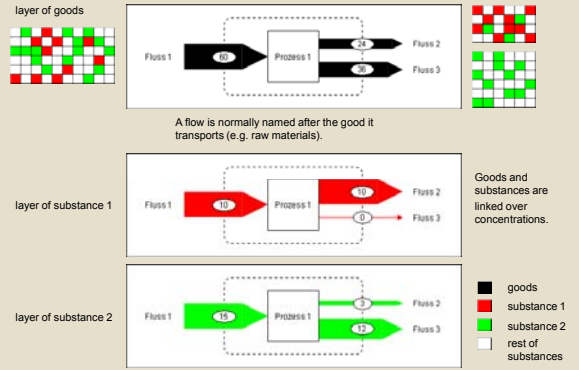
system boundary (in space and time)

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Build-up of MFA models (2)



Goods vs. Substances



C. F. Gauss (1777-1855)



mean value:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

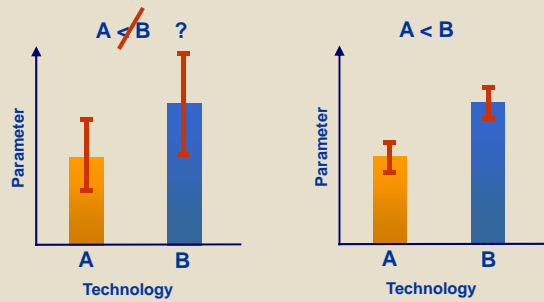
standard deviation:

$$s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$$

normal distribution



Comparison of Values



Data Reconciliation (1)

$\Sigma \text{ import} \neq \Sigma \text{ export} !$
 1 balance equation
 0 unknown variables
 → „overdetermined“
 → uncertainties given
 → data reconciliation!

$\rightarrow \Sigma \text{ import} = \Sigma \text{ export} !$
 → uncertainties are reduced !

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Data Reconciliation (2)

$\Sigma \text{ import} \neq \Sigma \text{ export} !$
 $\rightarrow \Sigma \text{ import} = \Sigma \text{ export} !$
 → values with higher uncertainty are reconciled stronger!

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Data Reconciliation (3)

$\Sigma \text{ import} \neq \Sigma \text{ export} !$
 2 balance equations
 2 unknown variables
 → „underdetermined“
 → uncertainties given
 → data reconciliation!

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Data Reconciliation (4)

data reconciliation

calculation + error propagation

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