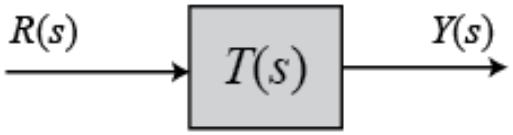
Transfer functions

FYS 3231 /4231



Thermo-anemometer

- Finn overførings-funksjonen (transfer-funksjonen)
- Inverter den for å bruke sensoren i reelle målinger

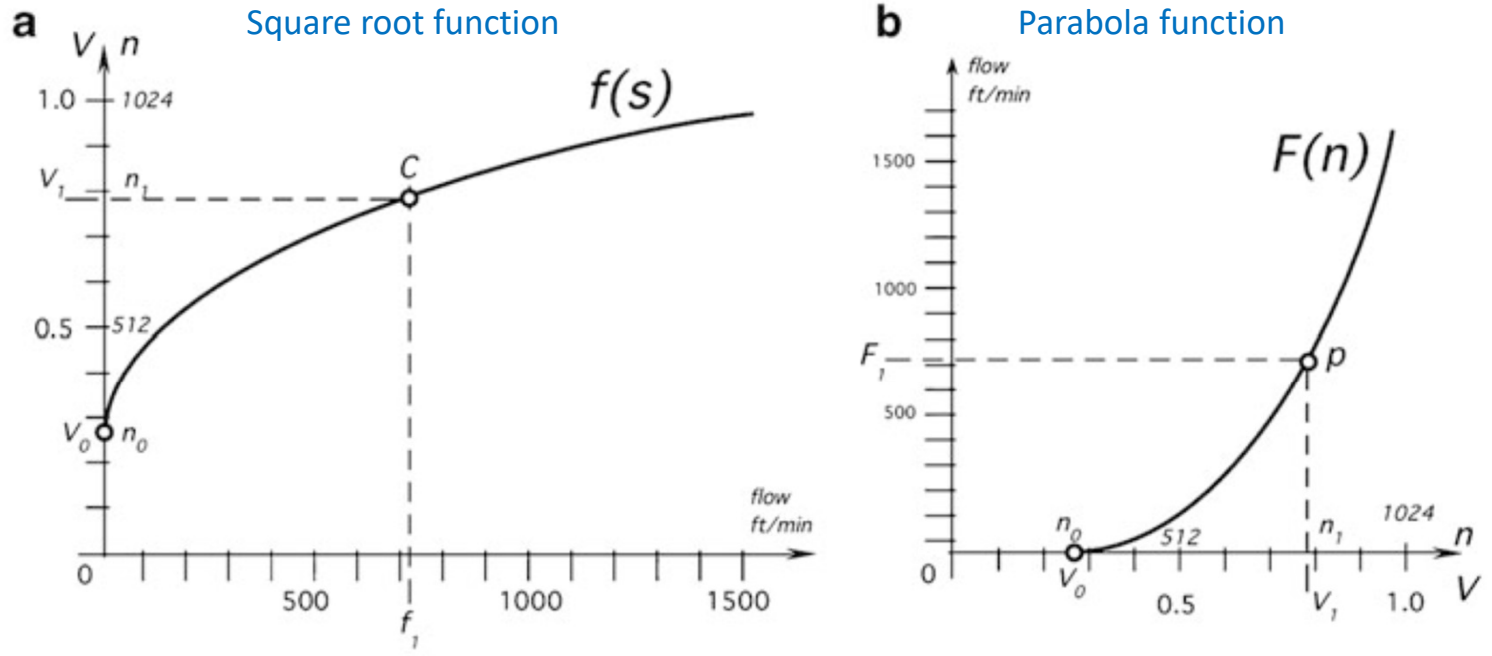
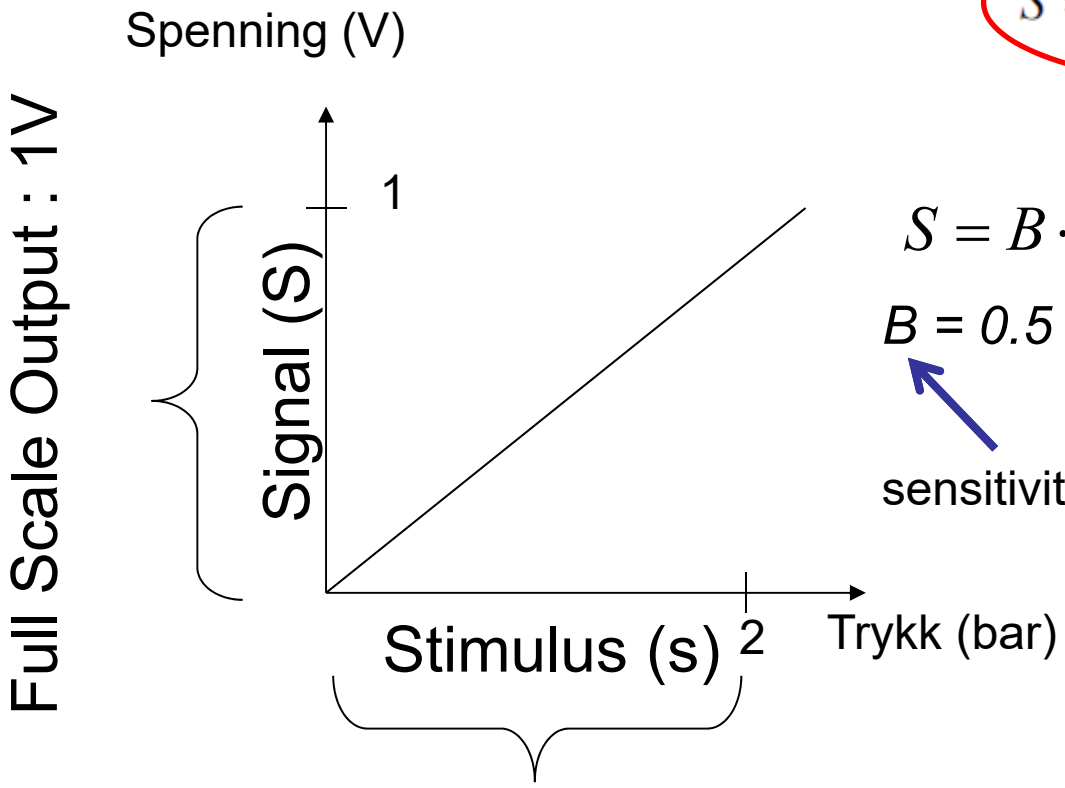


Fig. 2.1 Transfer function (**a**) and inverse transfer function (**b**) of thermo-anemometer

Lineær respons

$$S = S_0 + B(s - s_0)$$

Hvis det er vanskelig å teste ved s = 0 (f.eks. et kelvin-termometer)



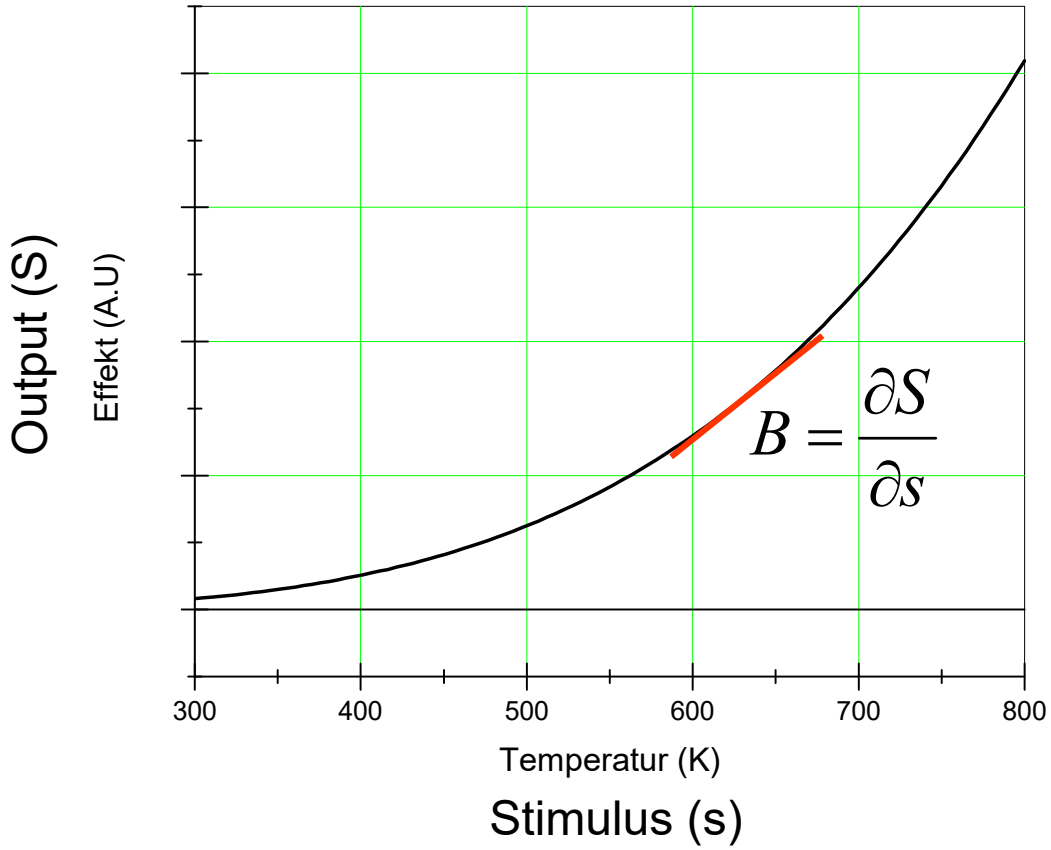
$$S = B \cdot s$$

B = 0.5 V/bar

sensitivitet

Eksponensielle
Logaritmiske
Power-functions

Følsomhet / sensitivitet



Kurvetilpasning

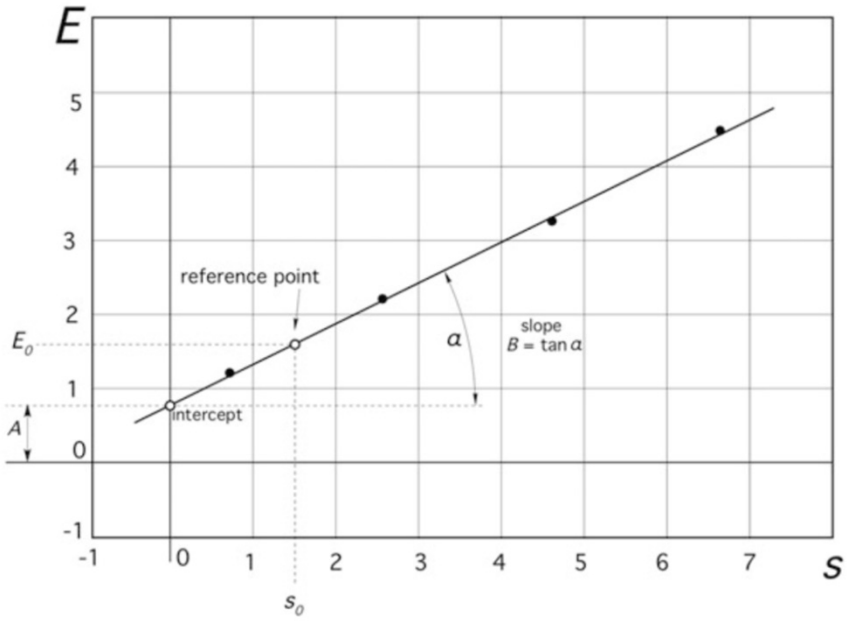
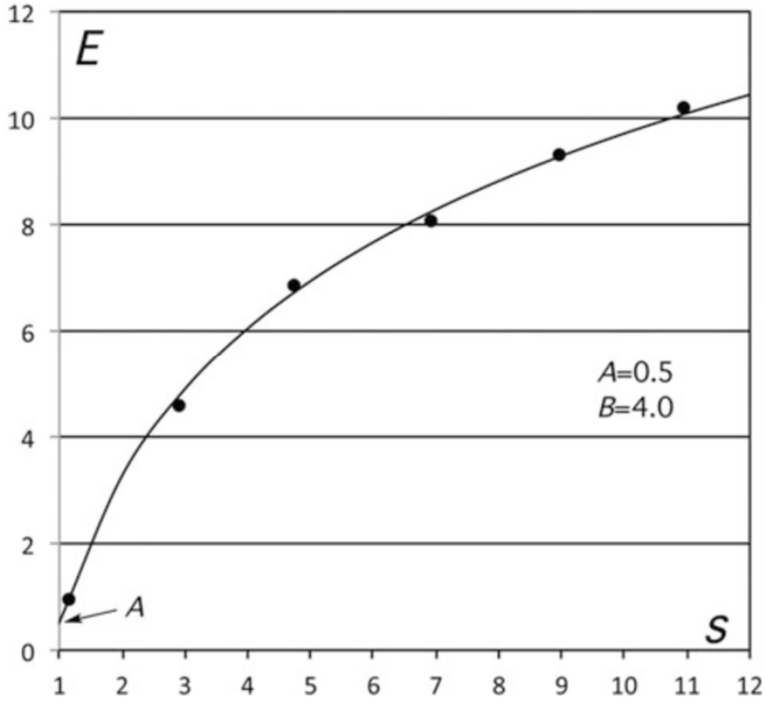


Fig. 2.2 Linear transfer function. *Black dots* indicate experimental data

Fig. 2.3 Approximation by logarithmic function. *Dots* indicate experimental data

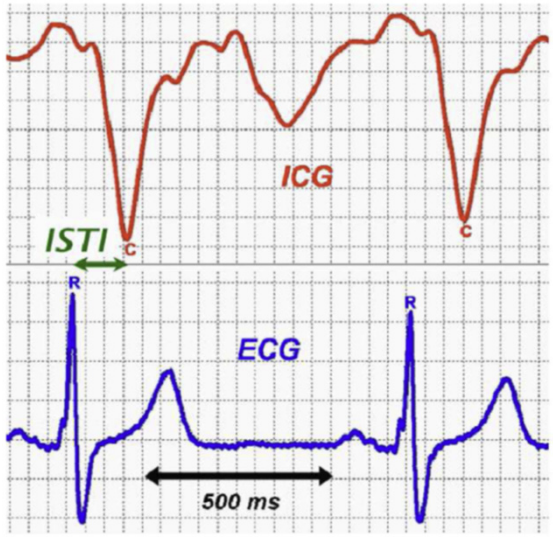


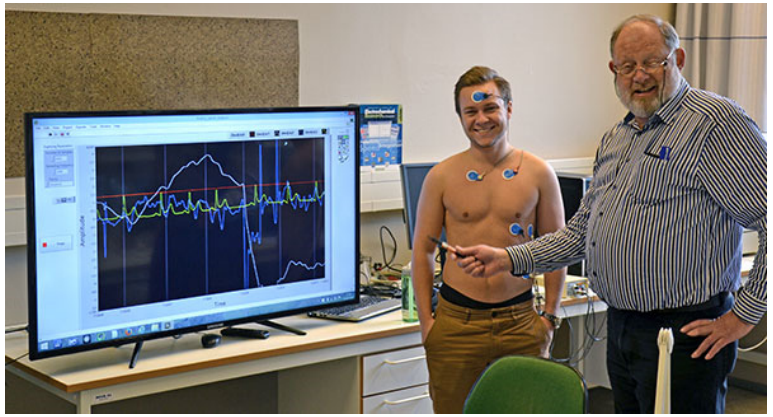
sensitivity

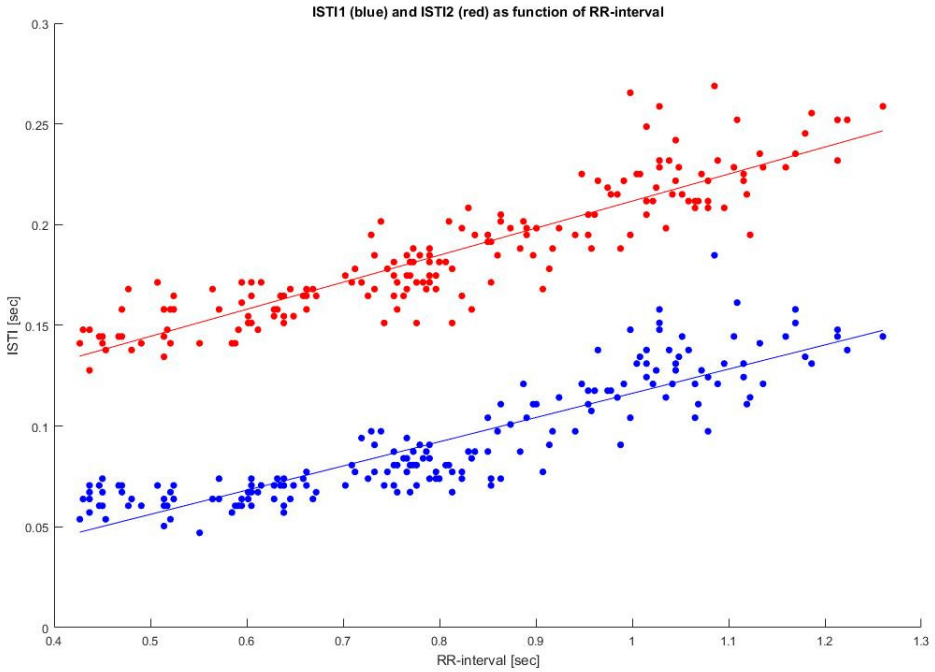
$$E = A + B \ln s,$$

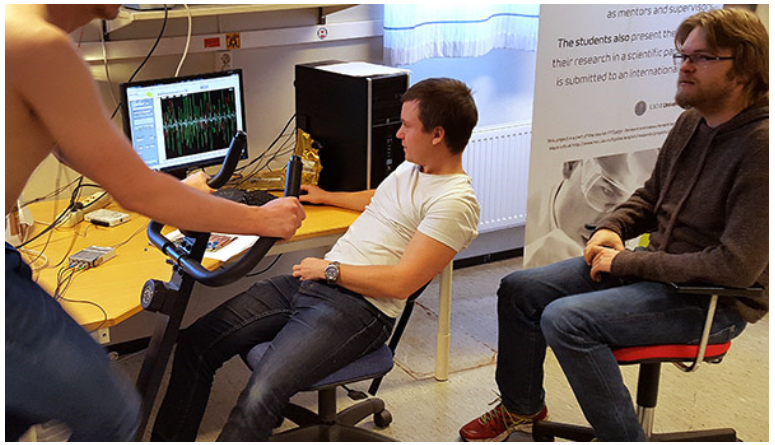
$$s = e^{\frac{E-A}{B}},$$

ICG (Sensorama 2015)









Linear piecewise approximation

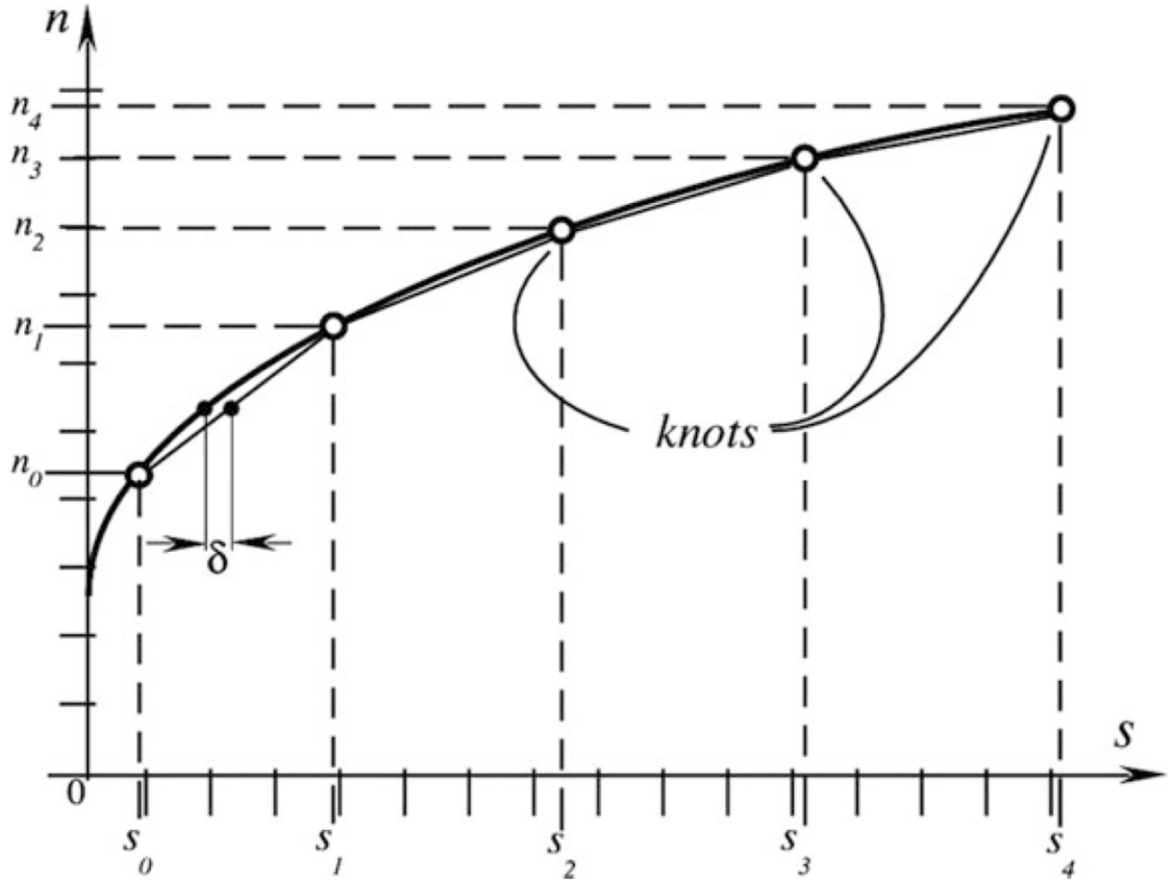
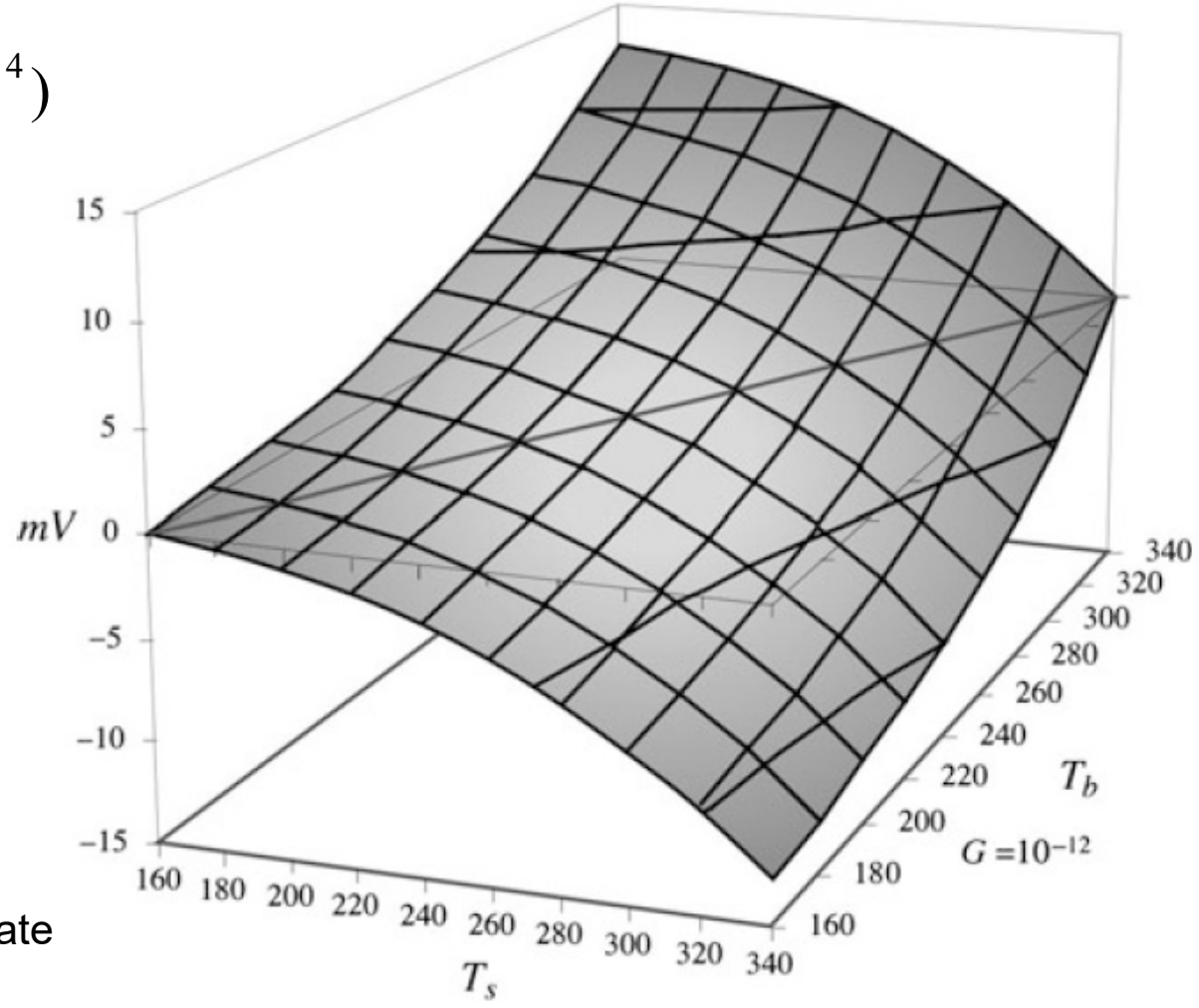


Fig. 2.6 Linear piecewise approximation

Multidimensjonale transferfunksjoner

$$V = G(T_b^{\,4} - T_s^{\,4})$$



T_s = sensoroverflate
T_b = objekt

Fig. 2.3 Two-dimensional transfer function of a thermal radiation sensor

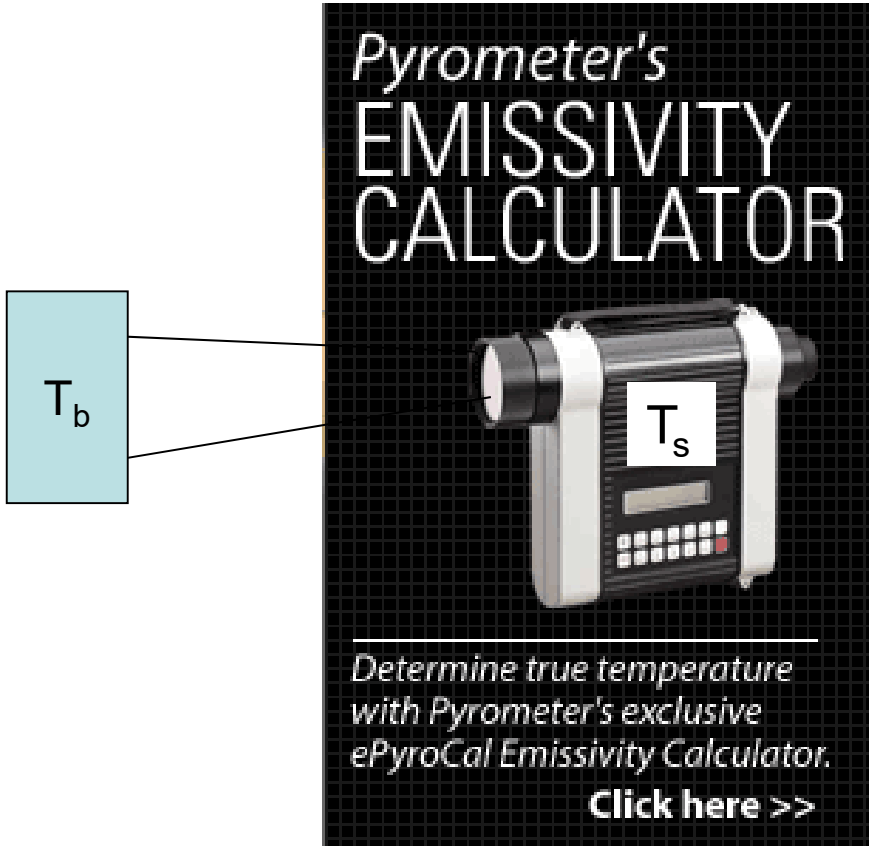
Eksponentiell respons - pyrometer

Utstrålt effekt

$$V = G(T_b^{\,4} - T_s^{\,4})$$

Følsomhet

$$B = \frac{\partial V}{\partial T_b} = 4GT_b^3$$



www.pyrometer.com

Kalibrering – finne transferfunksjonen

1. Calculation of the transfer function or its approximation to fit the selected calibration points (curve fitting by computing coefficients of a selected approximation).
2. Adjustment of the data acquisition system to trim (modify) the measured data by making them to fit into a normalized or "ideal" transfer function. An example is scaling of the acquired data.
3. Modification (trimming) of the sensor' properties to fit the predetermined transfer function.
4. Creating a sensor-specific reference device with matching properties at particular calibrating points.

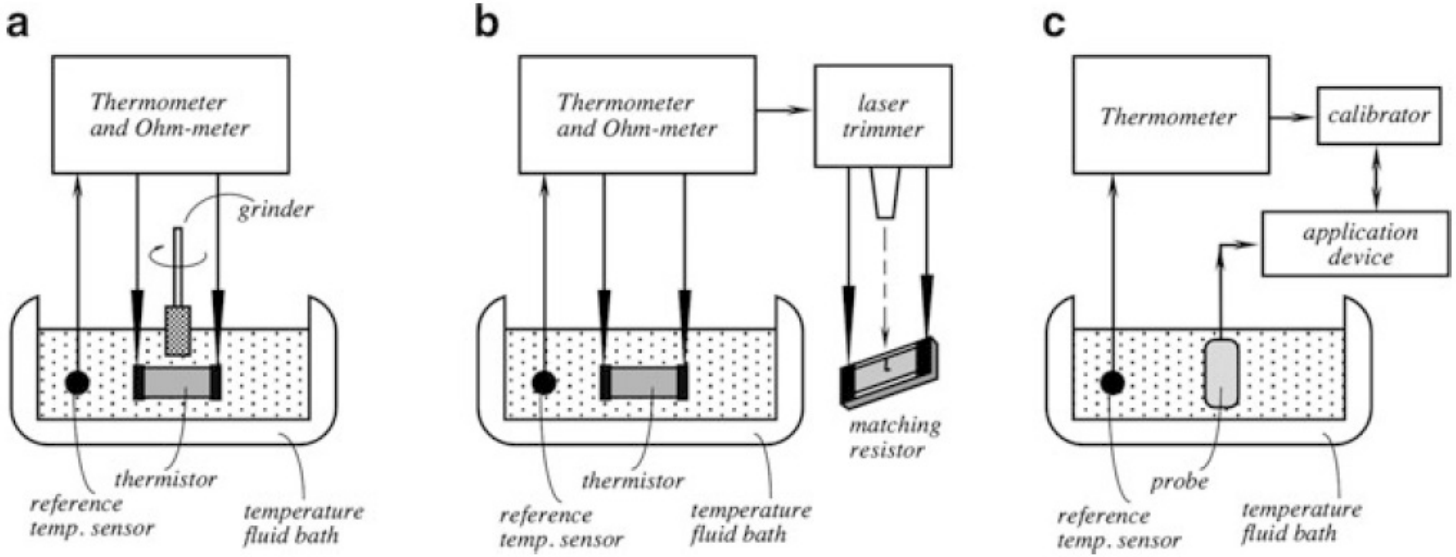
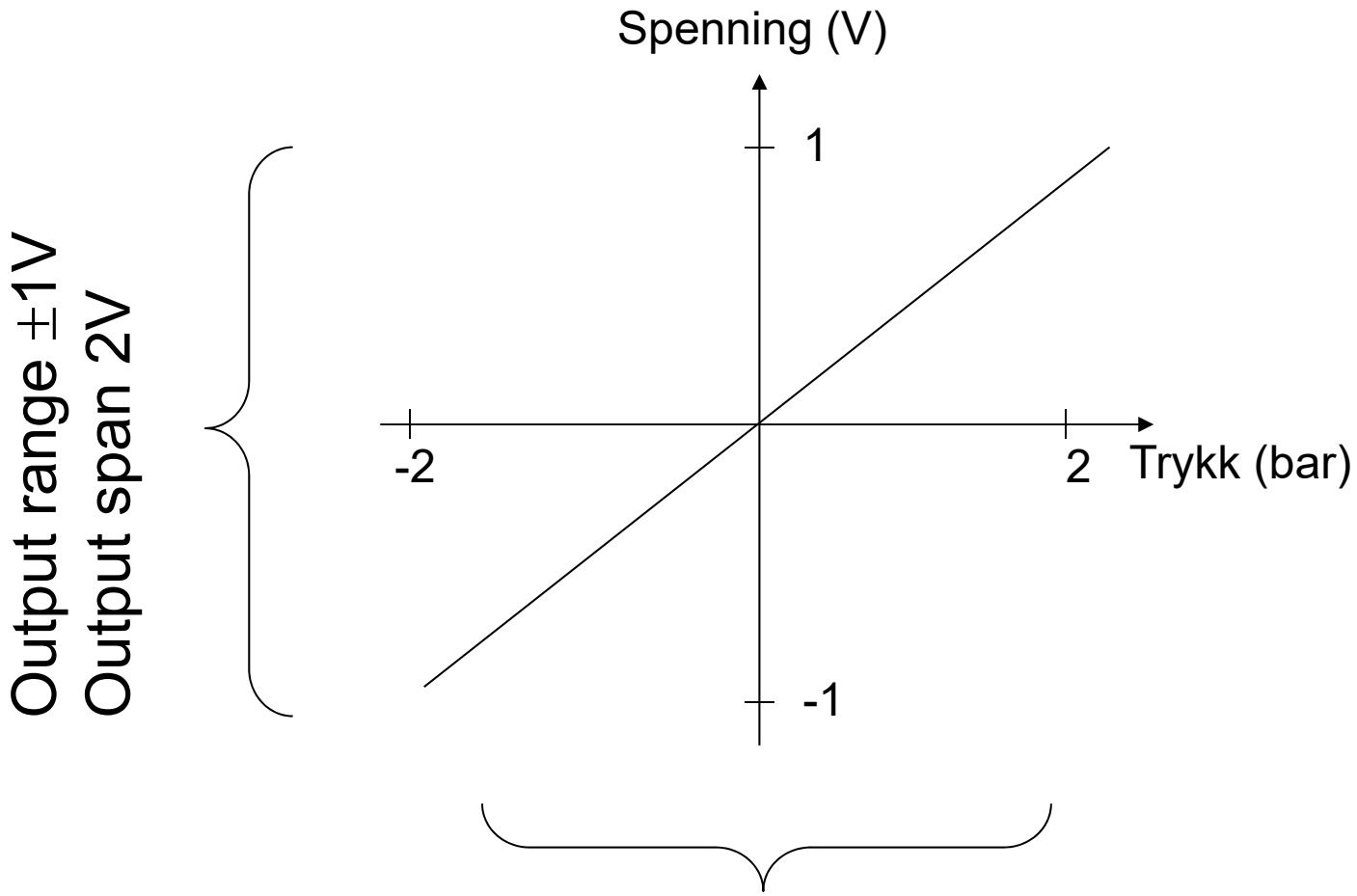
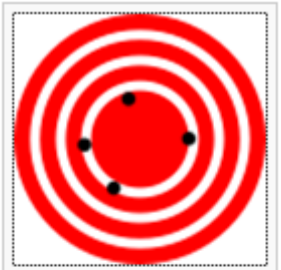


Fig. 2.4 Calibrations of a thermistor: grinding (**a**), trimming of a reference resistor (**b**), calculating the transfer function (**c**)

Span og range

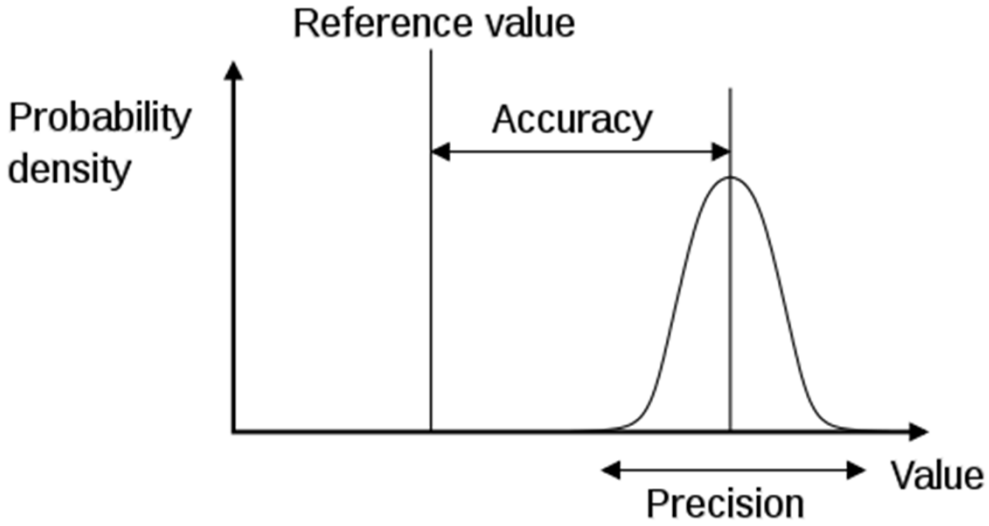


Nøyaktighet og presisjon



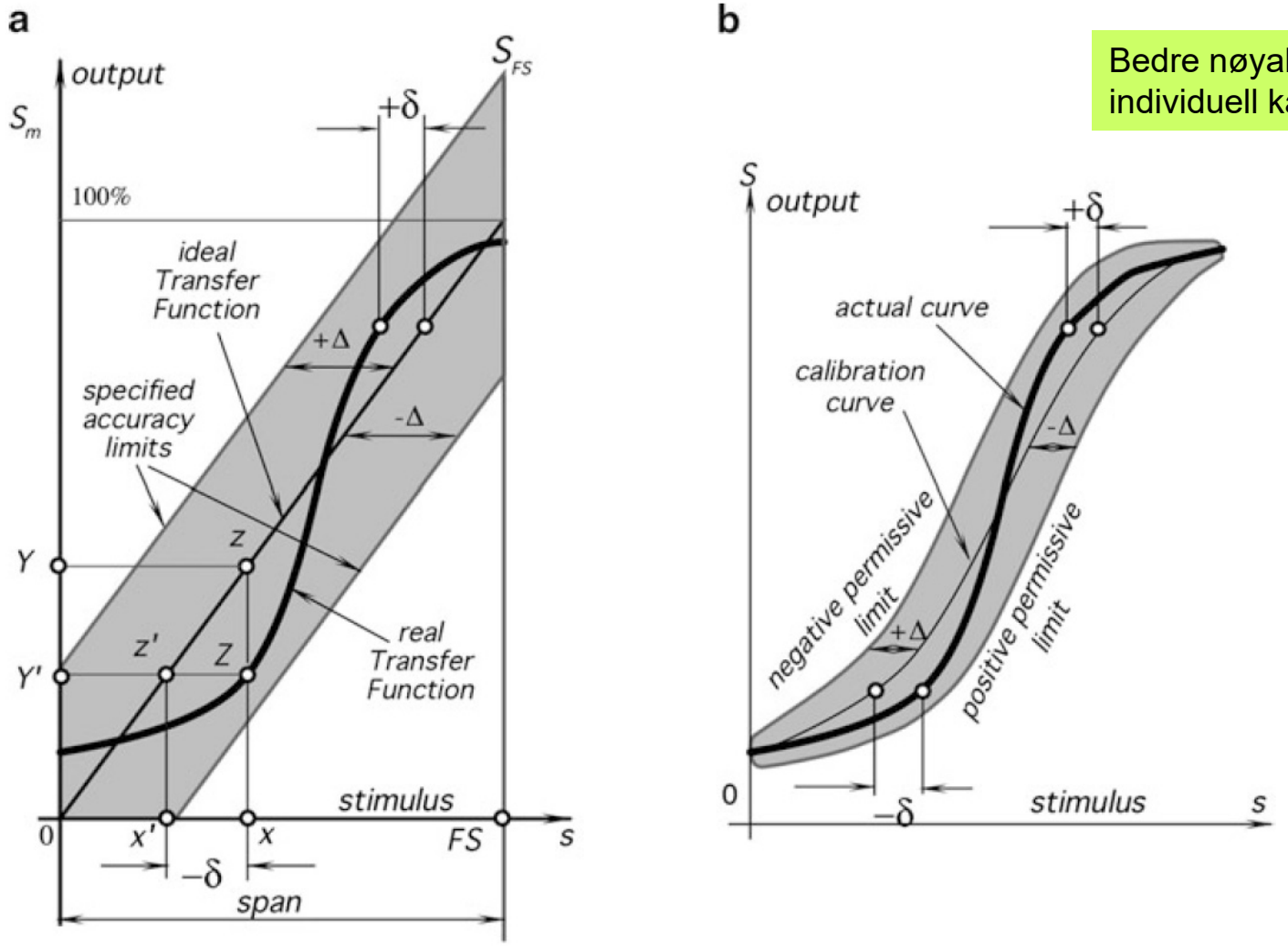
High **accuracy**, but low **precision**

High **precision**, but low **accuracy**



http://en.wikipedia.org/wiki/Accuracy_and_precision

Nøyaktighet



Bedre nøyaktighet etter individuell kalibrering

Fig. 2.9 Transfer function (**a**) and accuracy limits (**b**). Error is specified in terms of input values

Kalibreringsfeil

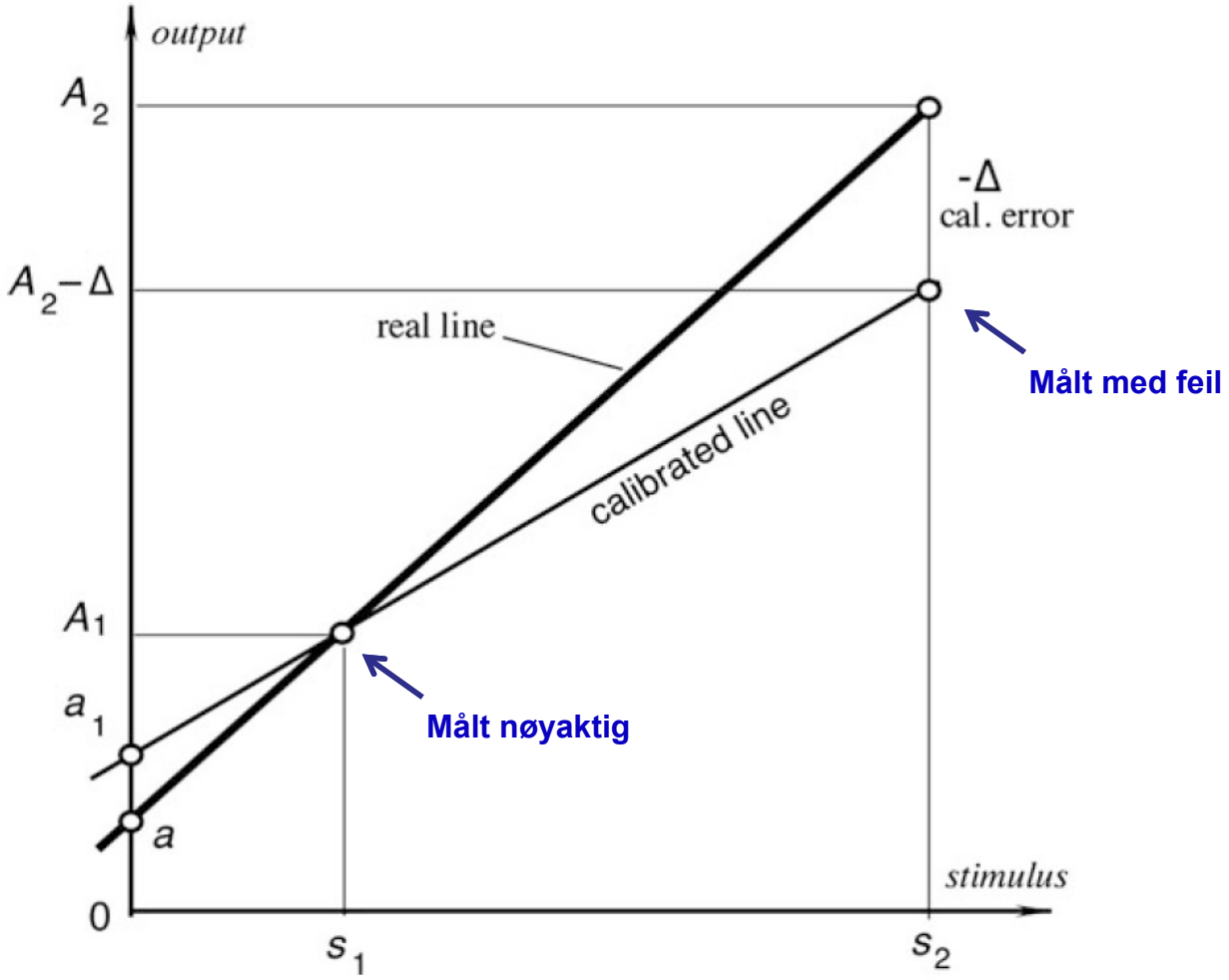


Fig. 2.10 Calibration error

Hysterese

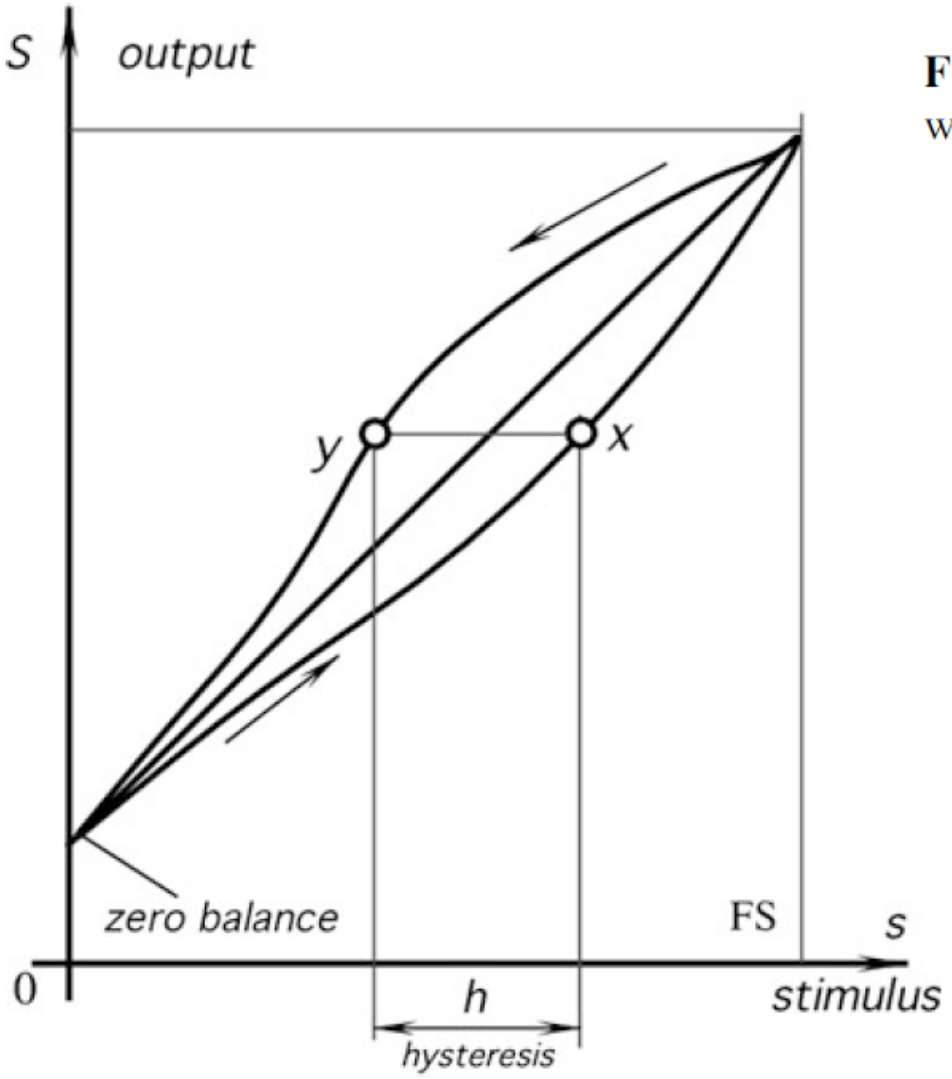


Fig. 2.11 Transfer function with hysteresis

Chua lectures by HP

Leon Chua Lecture #3

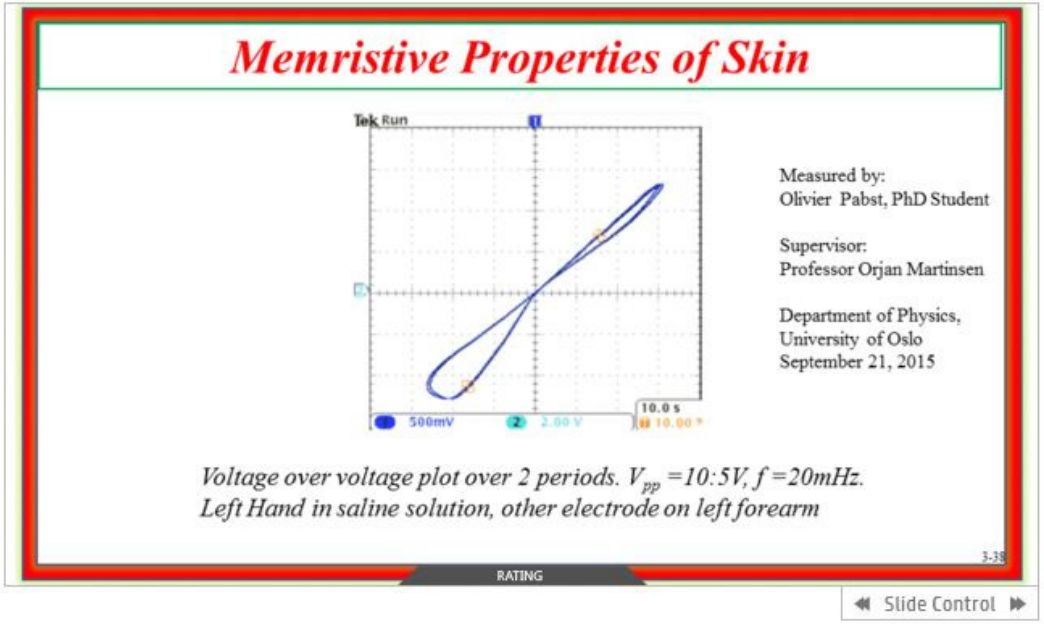
September 22, 2015

18:33 / 1:30:19

Quality 600k

Table of contents

- Memristor is defined by a State - Depender
- Memristor does not store energy
- The Ideal Memristor dies not have a DC V-
- Some Memristor Circuits have Hamiltonian
- Not all Hamiltonian Systems are Conserva



Data by Oliver Pabst

Ulinearitet

(for sensorer hvor det antas linearitet)

Måles ved endepunktene.
Linja kan flyttes for å oppnå
bedre nøyaktighet i ønsket område
(eks. febertermometer)

Best straight line
Independent linearity

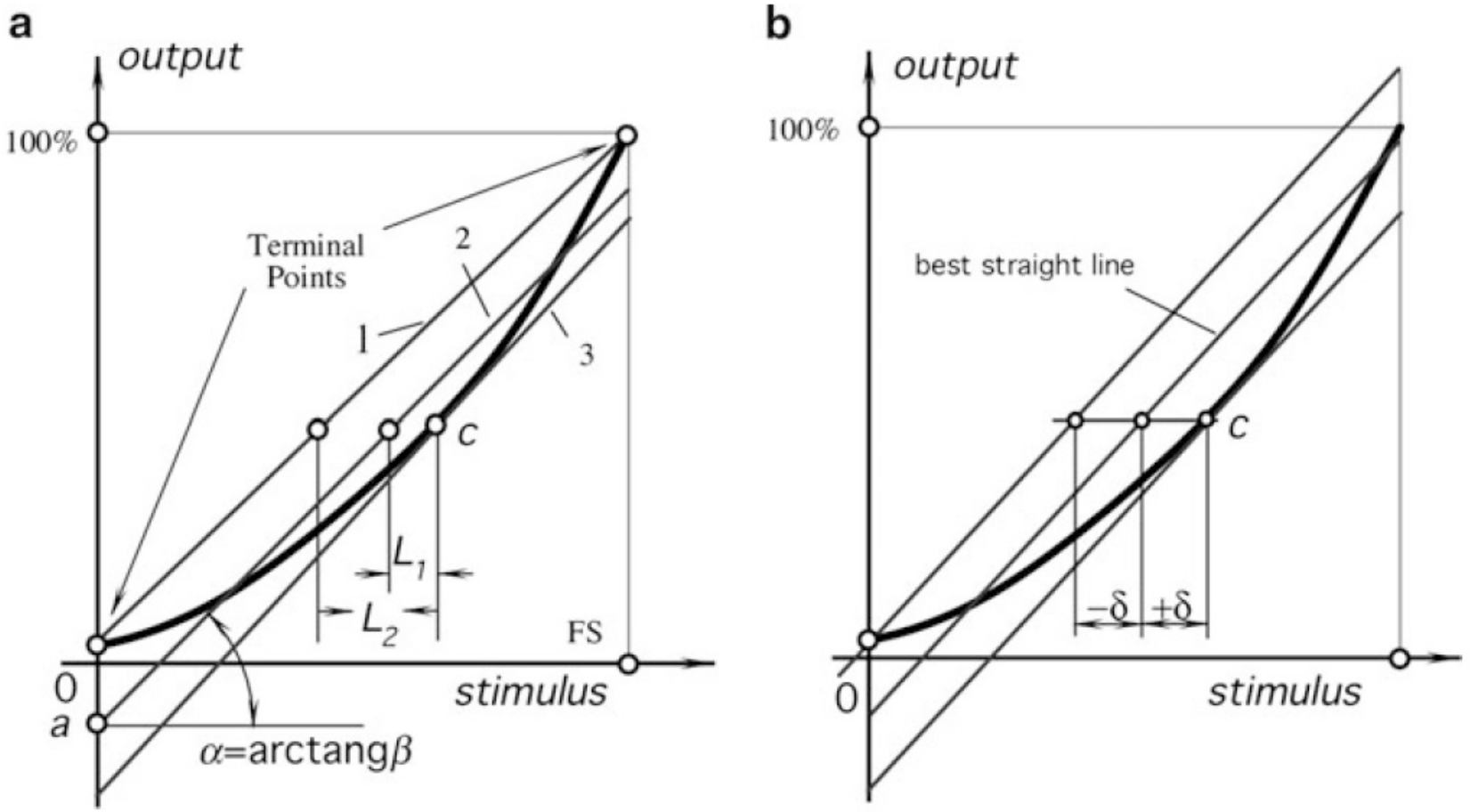


Fig. 2.12 Linear approximations of a nonlinear transfer function (**a**); and independent linearity; (**b**)

Repeterbarhet / dødbånd

Termisk støy,
oppladning,
endringer i materialet, ...

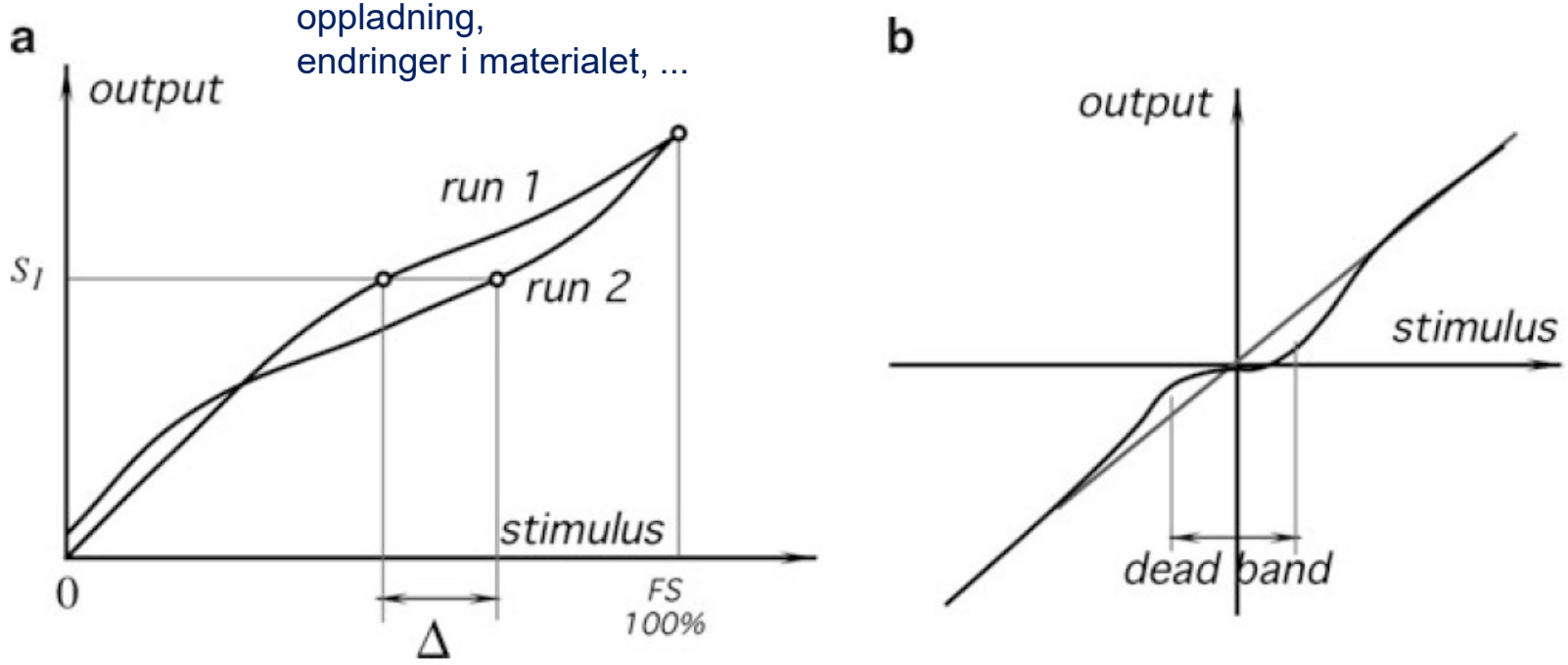


Fig. 2.14 Repeatability error (**a**). The same output signal S_1 corresponds to two different input signals Dead-band zone in a transfer function (**b**)

Oppløsning - fysisk

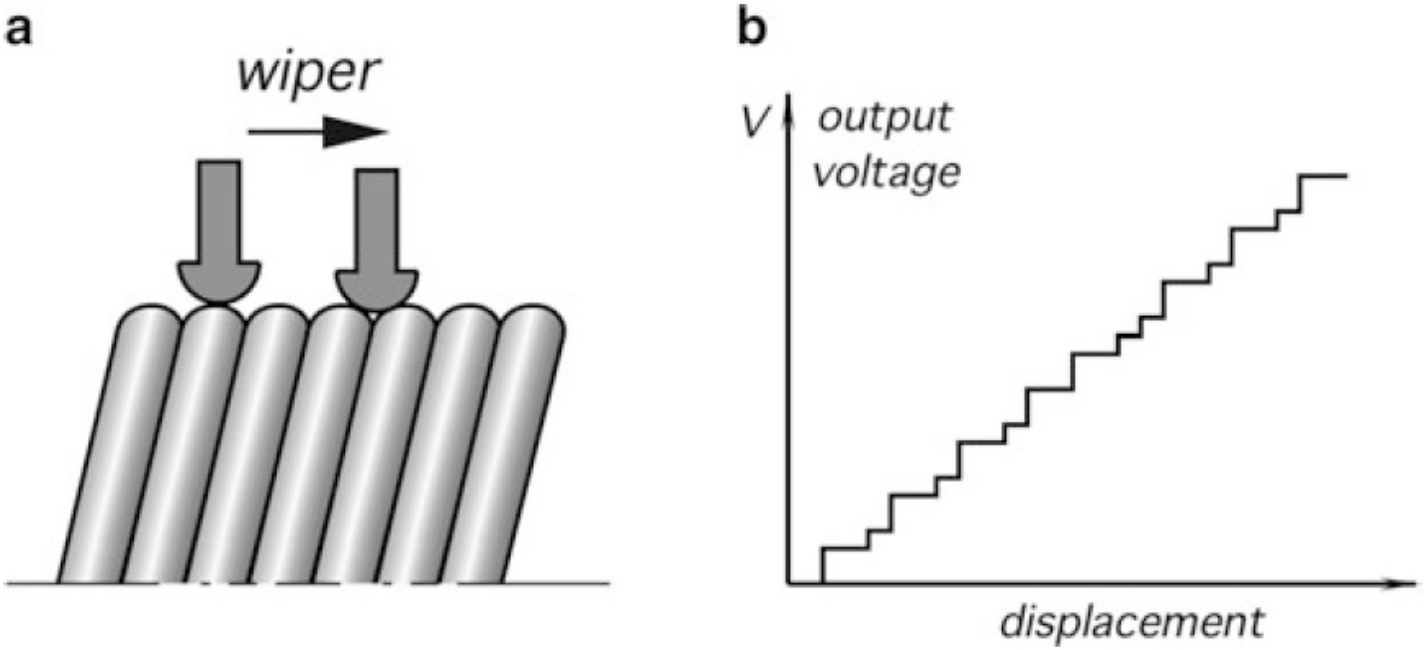


Fig. 7.2 Uncertainty caused by wire-wound potentiometer A wiper may contact one or two wires at a time (**a**); uneven voltage steps (**b**)

Oppløsning - støybegrenset

Fig. 5.45 Types of noise noise-free signal (**a**); additive noise (**b**); multiplicative noise (**c**)