

Magnetic measurements generally I

- Raw signals (analog $U_r(t)$ or, respectively, its discretized digital U_i counterpart form) must be specially maintained:
 - corrected for the DC bias U_{offset} of the measurement circuit,
 - integrated (pure diagnostics signal voltage $U_d(t)$ is induced by the time derivative of the appropriate magnetic flux),
 - multiplied by calibration factors C_d (C_{Bt} , C_{RC}).
- We can express the basic relationship $U_r(t) = U_d(t) + U_{offset}$
- The measured signal $U_d(t)$ is proportional to the time derivative of the original physical quantity $D(t)$ signal (it is a magnetic measurement):

$$U_d(t) \propto \frac{dD(t)}{dt}, \text{ or } U_d(t) = C_d \frac{dD(t)}{dt}$$

Where the linearity coefficient C_d is called a calibration factor.

Magnetic measurements generally II

- To determine the desired physical quantity $D(t)$, we just have to perform an integration over time:

$$D(t) = \frac{1}{C_d} \int_0^t U_d(t') dt' = \frac{1}{C_d} \int_0^t (U_r(t) - U_{offset}) dt'$$

- In reality, the measurement is not continuous. The system performs a series of measurements U_i separated by with time step $\Delta t = 1 \text{ us}$.
- In practice, we replace the integral by a sum:

$$D_i = \frac{1}{C_d} \sum_{j=0}^{t/\Delta t} (U_i(t_j) - U_{offset}) \Delta t$$

$$D_i = \frac{1}{C_d} \left(\sum_{j=0}^{t/\Delta t} U_i(t_j) \right) - U_{offset} t$$

- The offset U_{offset} can be specified from the beginning of the data series before switching on the real experiment.