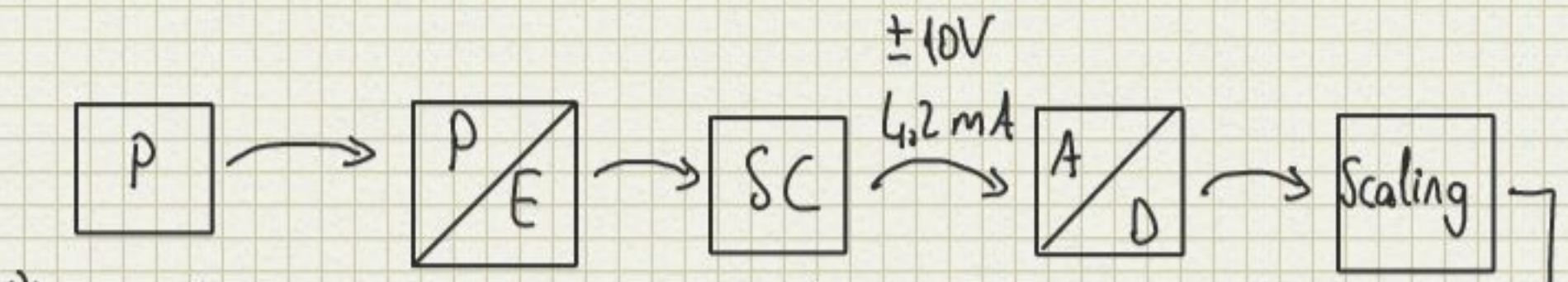
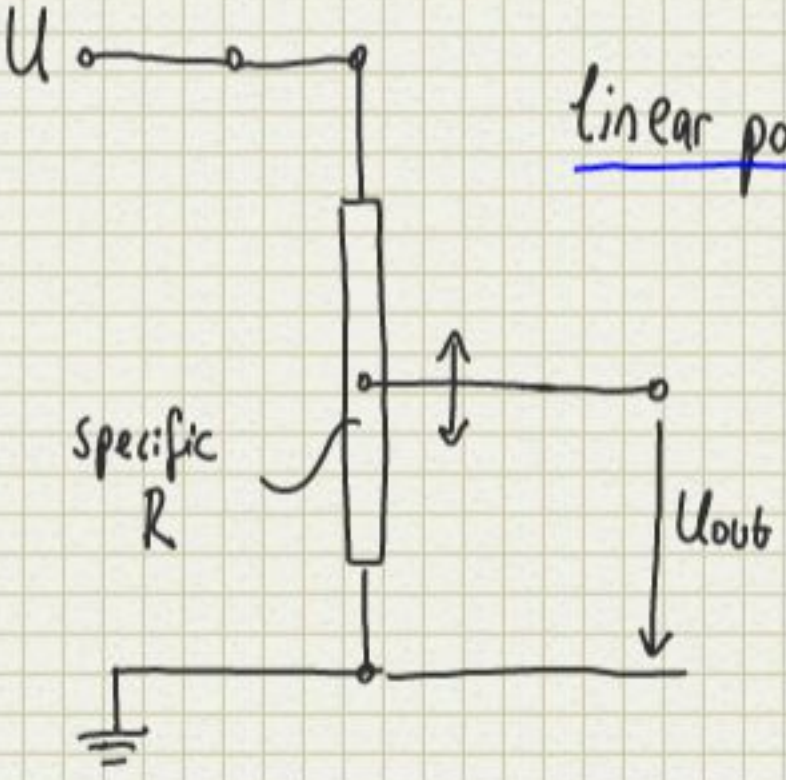
4.5.18

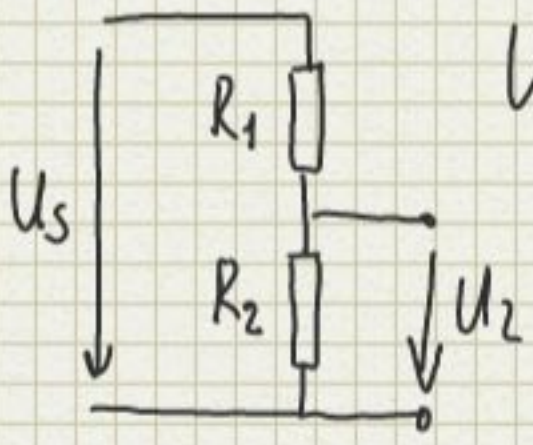
Analogue Data Acquisation



physical effects : changes in resistance, capacity or inductance

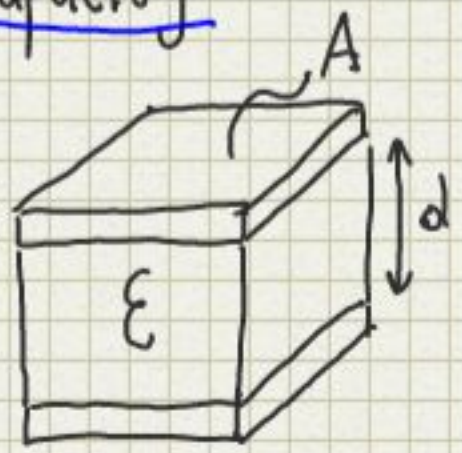


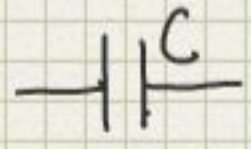
linear potentiometer



$$U_2 = \frac{R_2}{R_1 + R_2} U_s$$

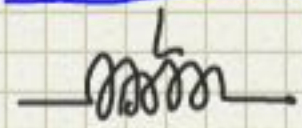
Capacity

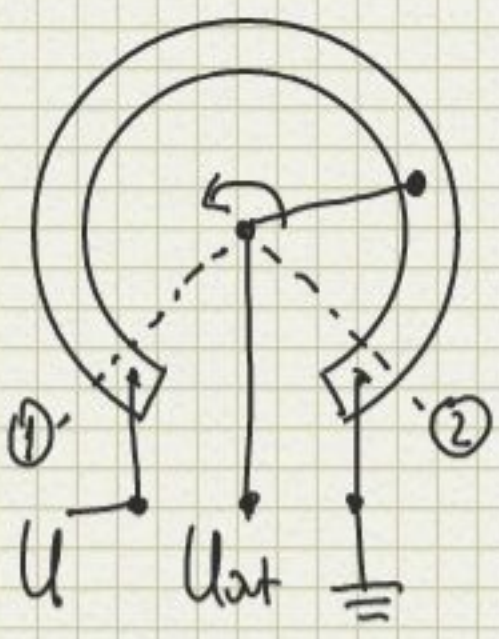




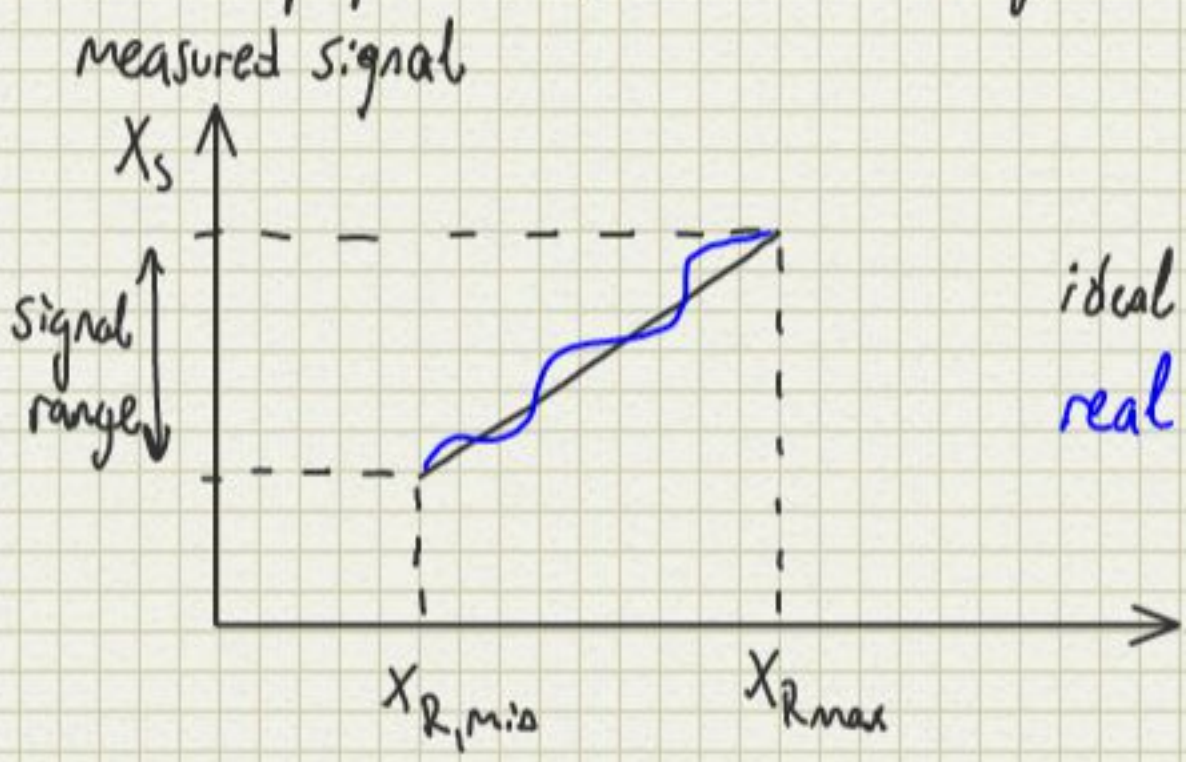
$$C = \frac{\varepsilon A}{d}$$

Inductance





Static properties of measurement systems



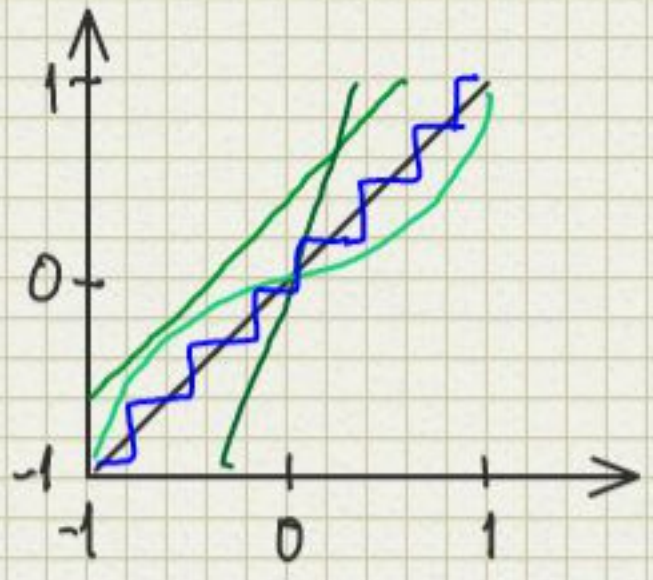
ideal characteristic (curve)

real characteristic

characteristic model $X_S = f(X_R)$

gain error
offset error (bias)
non-linearity
hysteresis
digitizing error

} differences of real and ideal characteristic



ideal

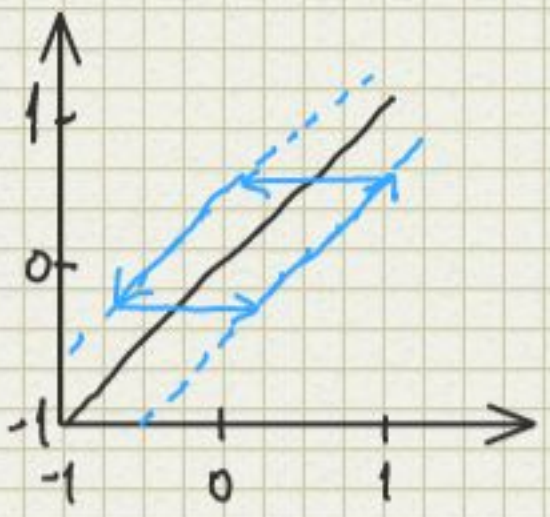
offset

gain

non linearity

digitizing

hysteresis



Deviances from ideal characteristic

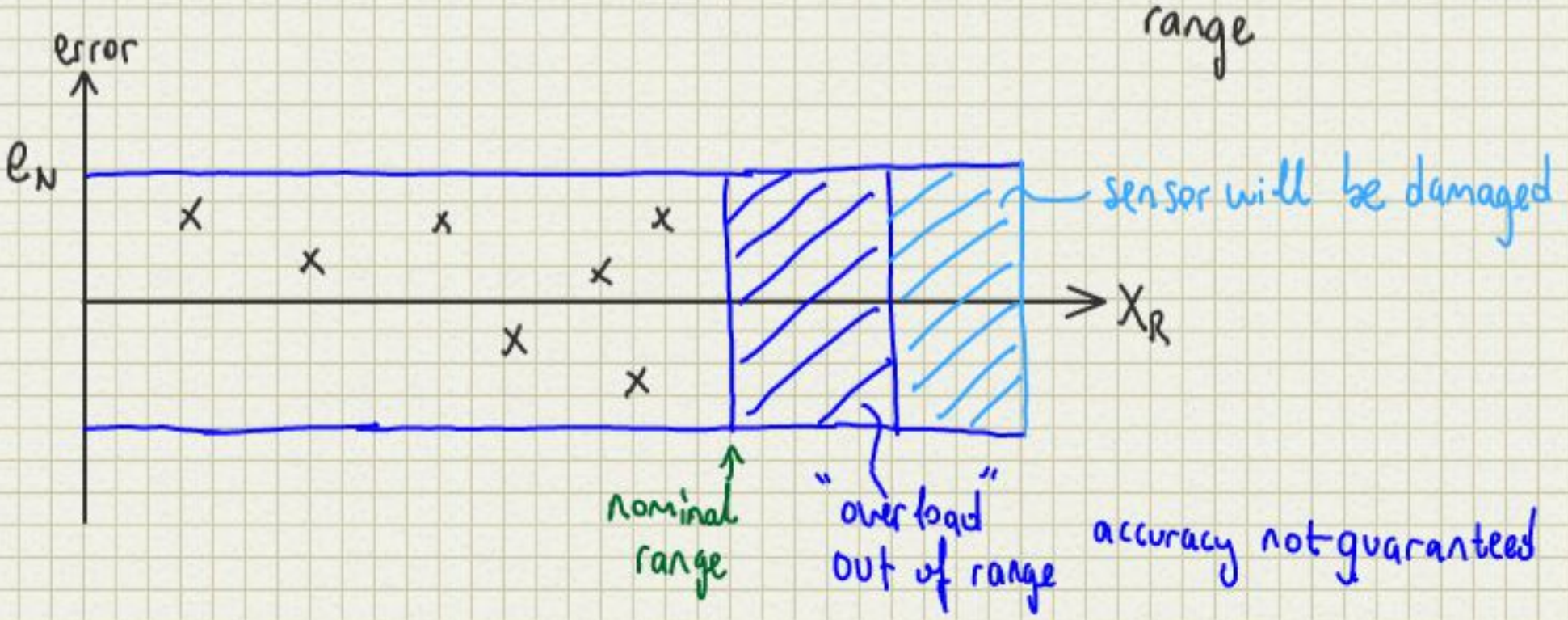
$X_R^* = X_S^*$ $\quad X_S$ value of signal

X_R " measured quantity

absolute error $\quad e_{abs} = X_R - X_S$

relative " $\quad e_{rel} = \dfrac{X_R - X_S}{X_S}$

nominal error $\quad e_{nom} = \dfrac{X_R - X_S}{X_N}$ $\quad X_N = \underbrace{X_{S,max} - X_{S,min}}_{\text{range}}$



range -100 N - 100 N $\Longrightarrow$ $X_N = 200$

accuracy 2 %

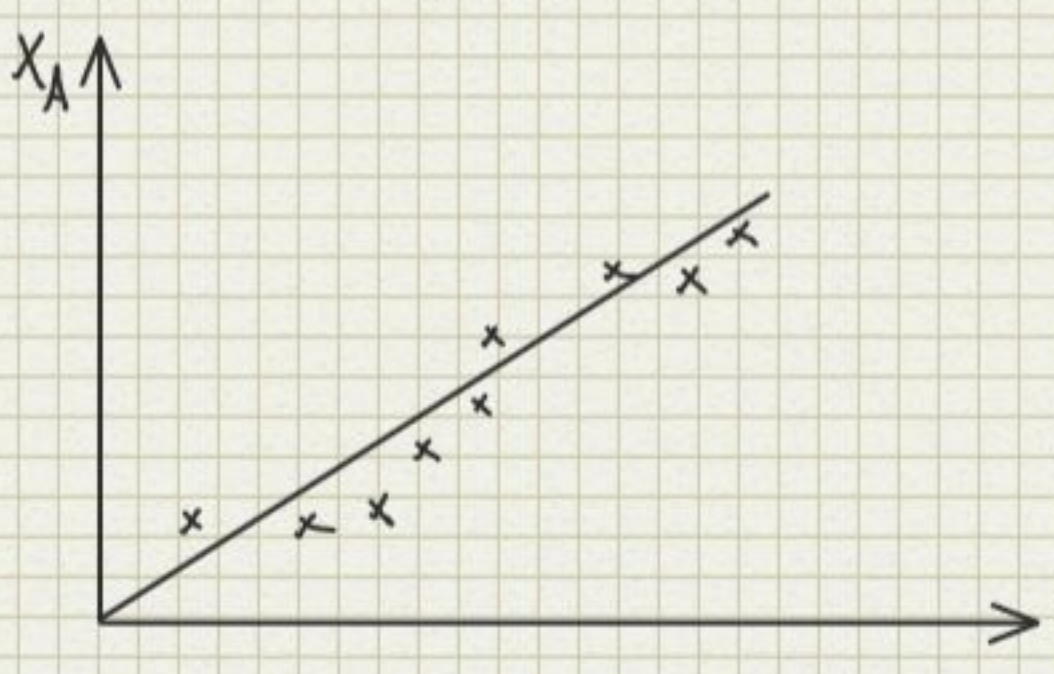
A measurement device is defective, when nominal error exceeds specified error range anywhere within measurement range

Calibration of Measurement Devices

1. Acquire a calibration normal

   ex. known mass (1g, 1kg, ...)

2. Calibration Measurement



#	X_R	X_A
1	0N	0,1V
2	10N	0,3V
3	20N	0,5V
n	xN	...

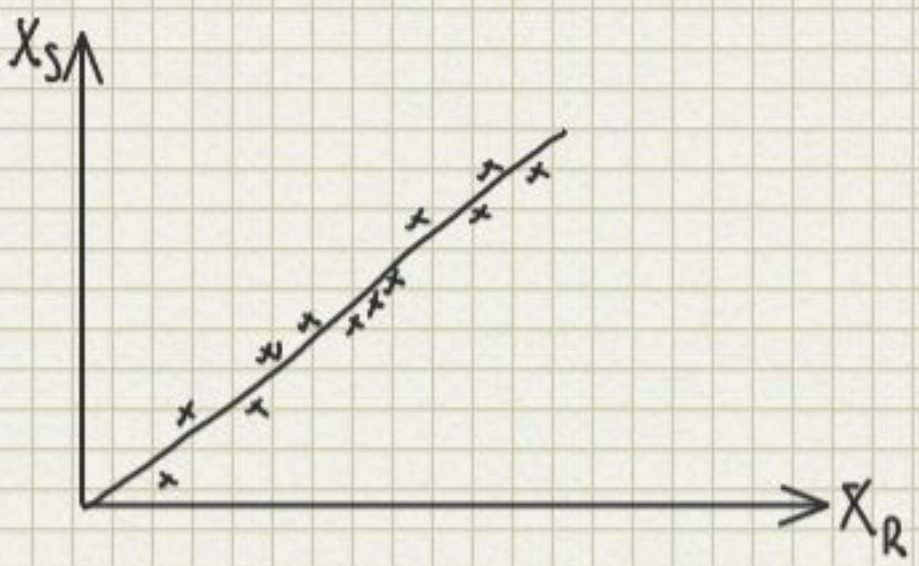
3. Modeling of static behaviour

   find suitable mathematic function to describe behaviour

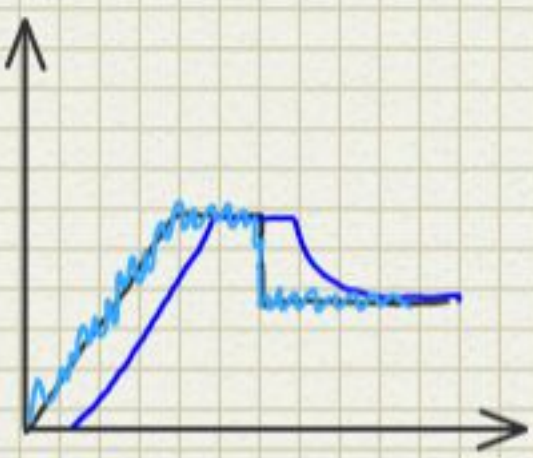
   $X_S = f(X_A)$

   linear example $X_S = aX_A + b$

polinomial $X_S = a_0 + a_1 X_A + a_2 X_A^2 + \dots + a_n X_A^n$

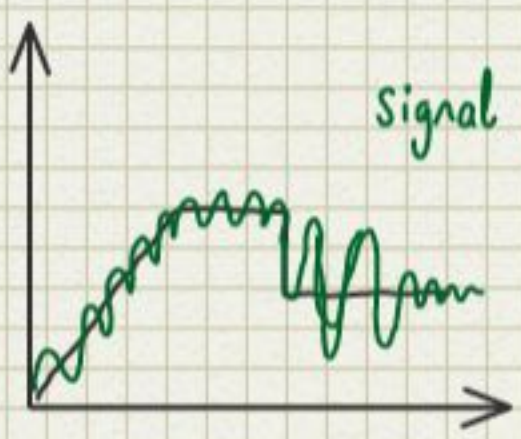


Dynamic Effects of Signals



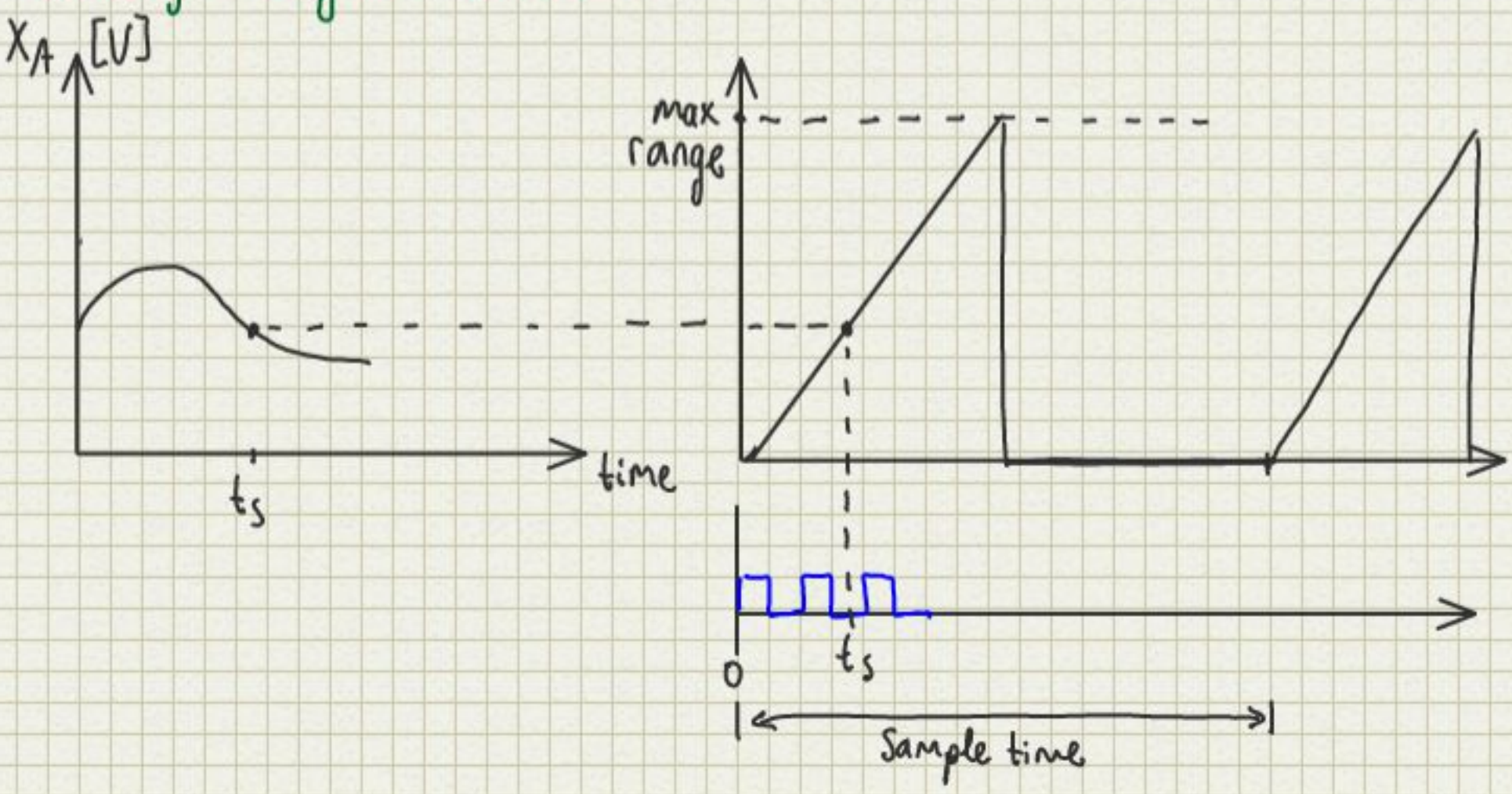
signal lag

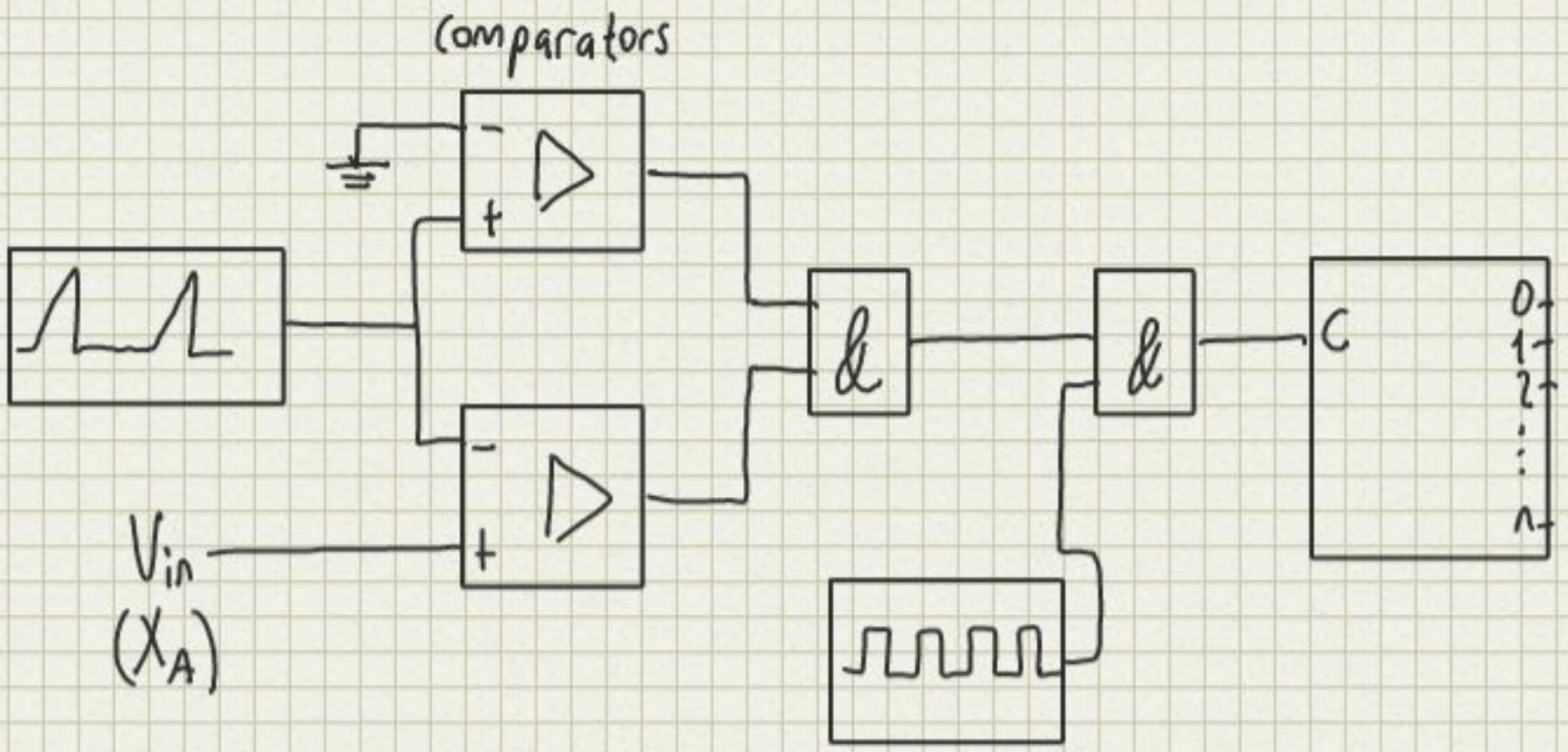
signal noise



signal oscillations

Analog to Digital Conversion





analog-dijital dönüşüm belirli bir zaman alır. Görüten değer o anki değil belirli bir süre önceki değerdir. Bu gecikmeye jitter denir