



Co-funded by the
Erasmus+ Programme
of the European Union

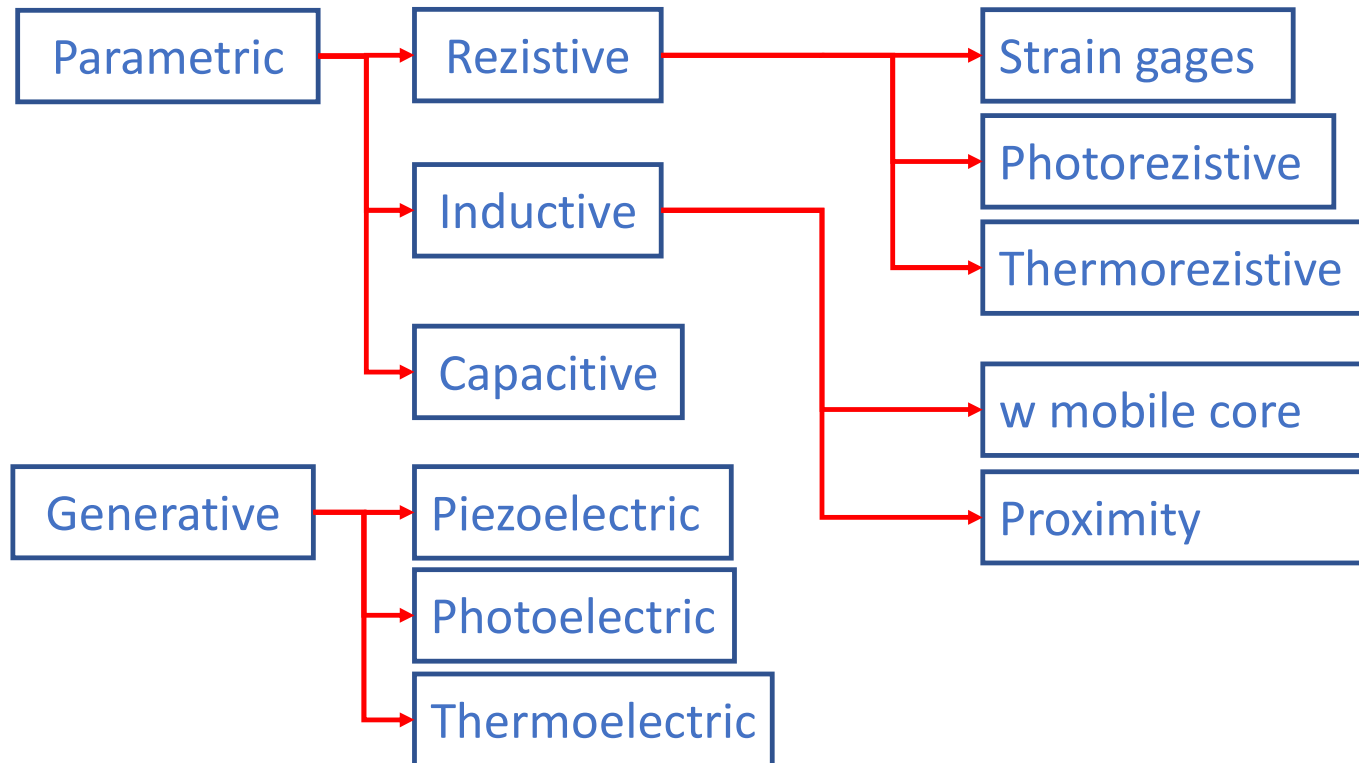


Cyber-Physical Industrial Systems

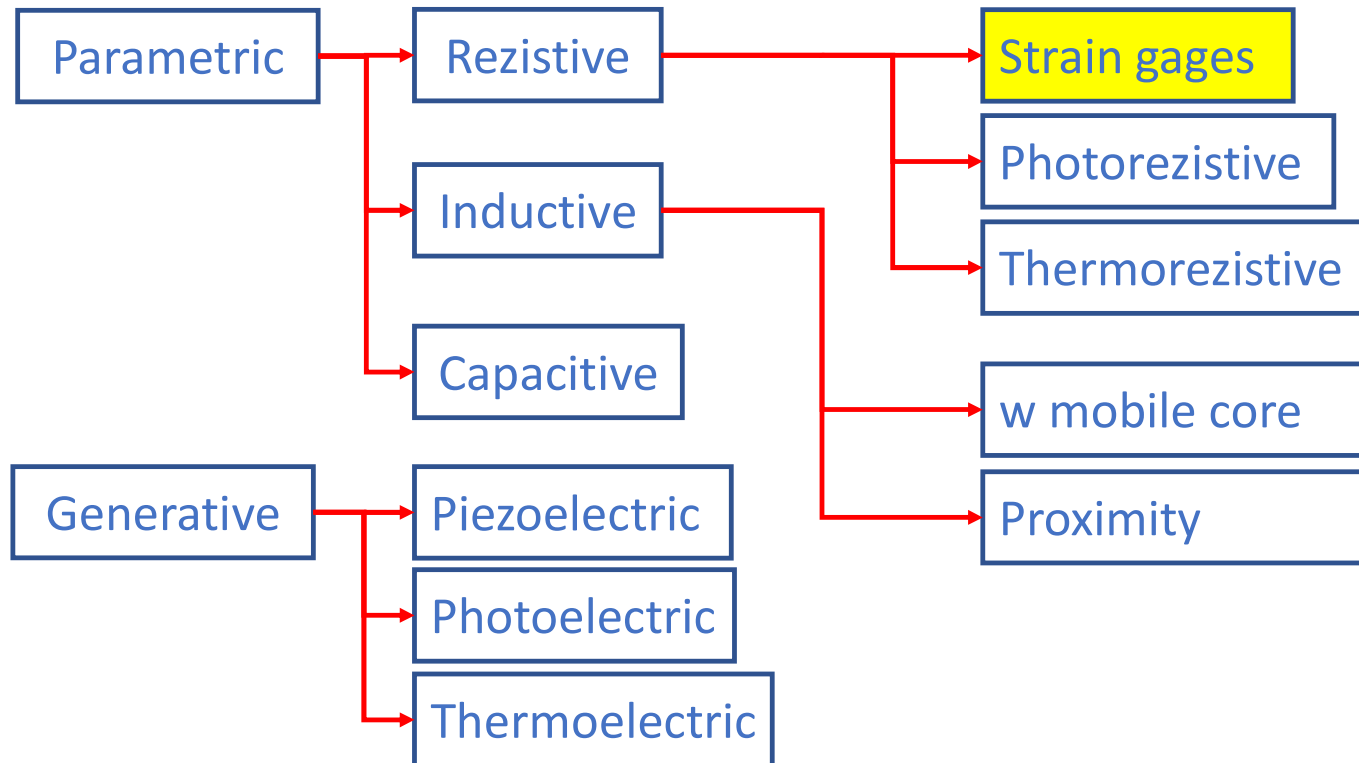
Module 1 Session 2
Types of transducers
Lecture



Transducers classification

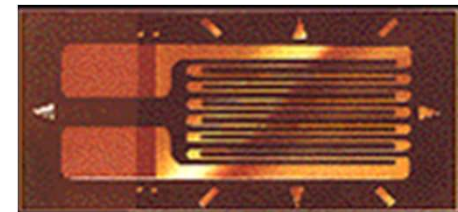
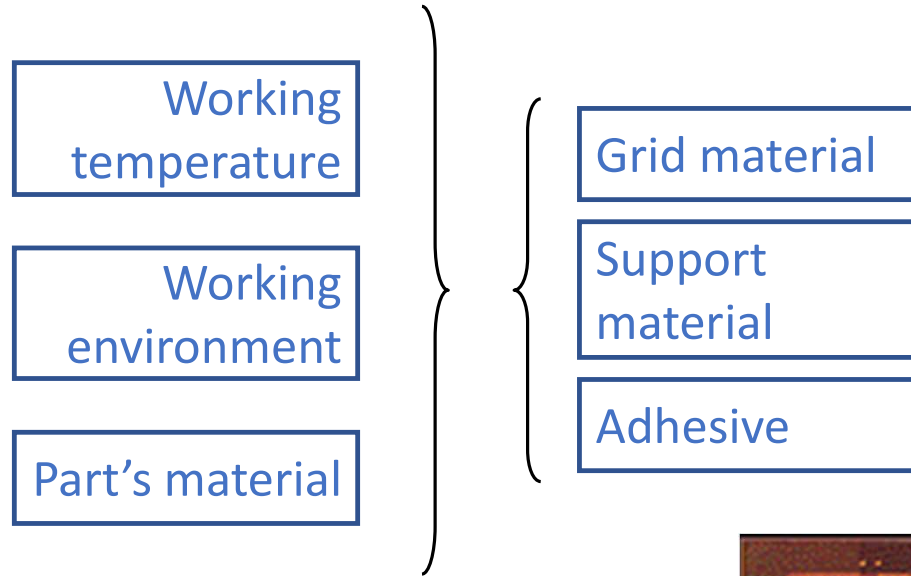
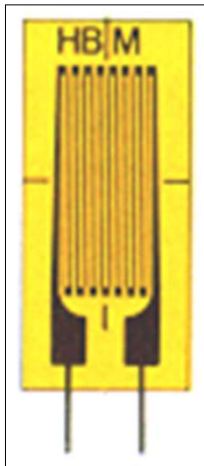


Transducers classification

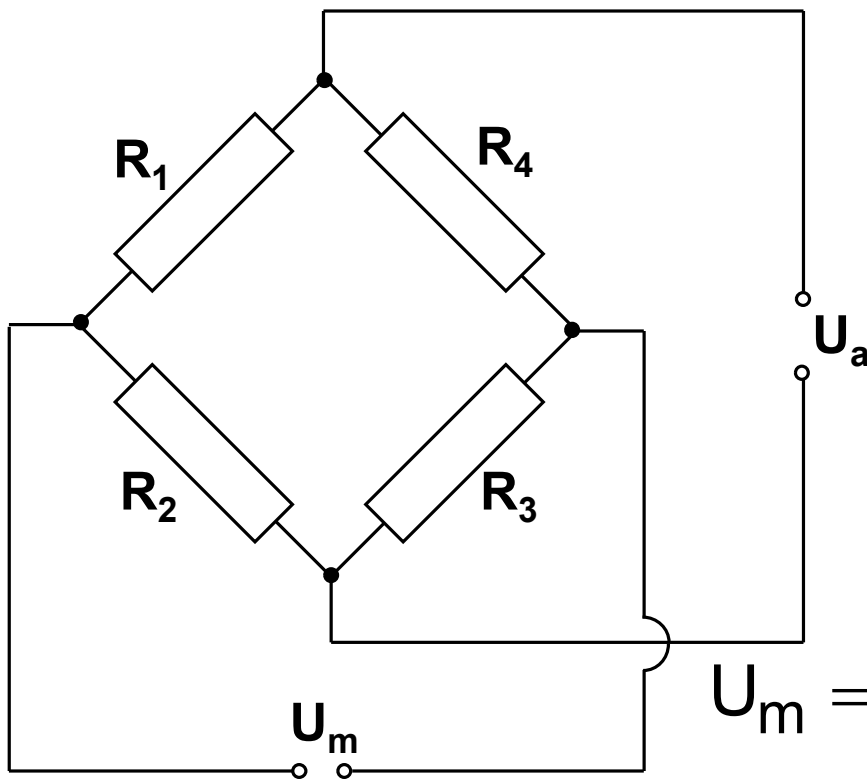


Straining gages: characteristics

$$R = \frac{\rho \cdot l}{S}$$



Straining gages: Wheatstone bridge



$$R_i = 120 \Omega$$

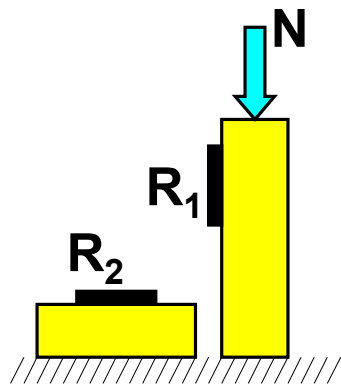
$$U_a \in \{1, 2, 4, 8\} \text{ V}$$

$$U_m \in [-10, 10] \text{ V}$$

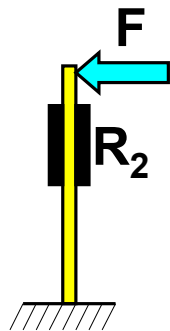
$$U_m = k \cdot U_a \cdot \left(\frac{\delta R_1}{R_1} - \frac{\delta R_2}{R_2} + \frac{\delta R_3}{R_3} - \frac{\delta R_4}{R_4} \right)$$



Straining gages: compensating temperature effects



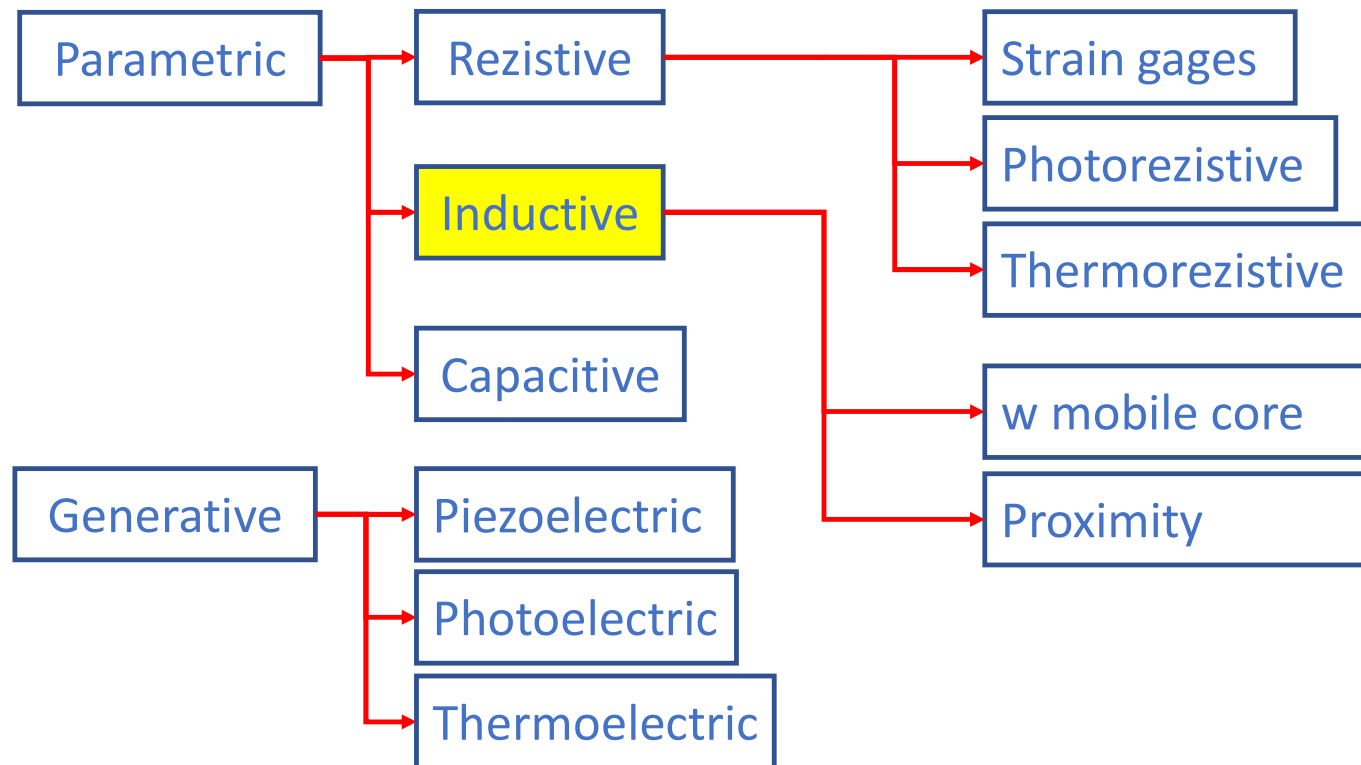
$$U_m = k \cdot U_a \cdot \left(\frac{\delta R_1}{R_1} + \frac{\delta R_{1t}}{R_1} - \frac{\delta R_{2t}}{R_2} \right) = k \cdot U_a \cdot \frac{\delta R}{R}$$



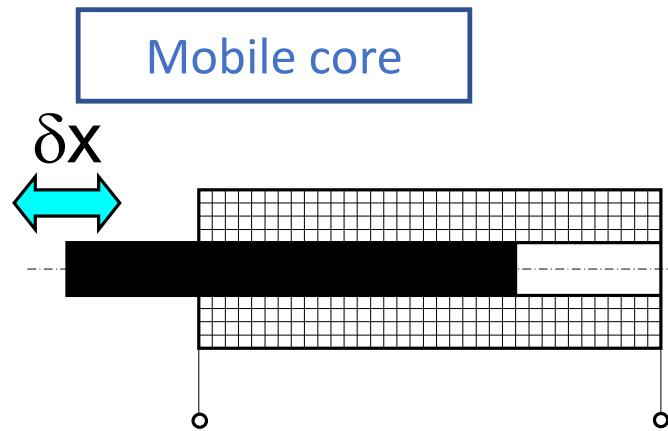
$$U_m = k \cdot U_a \cdot \left(\frac{\delta R_1}{R_1} + \frac{\delta R_{1t}}{R_1} - \frac{\delta R_2}{R_2} - \frac{\delta R_{2t}}{R_2} \right) = 2 \cdot k \cdot U_a \cdot \frac{\delta R}{R}$$



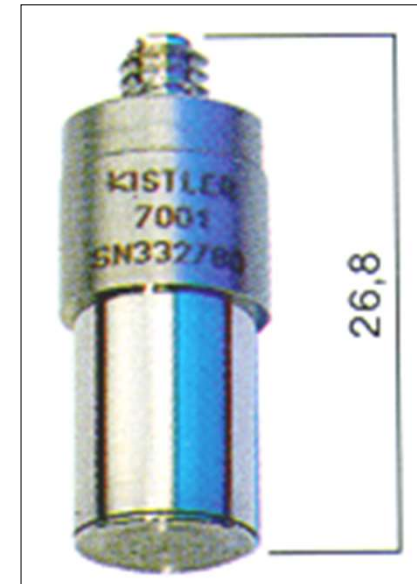
Transducers classification



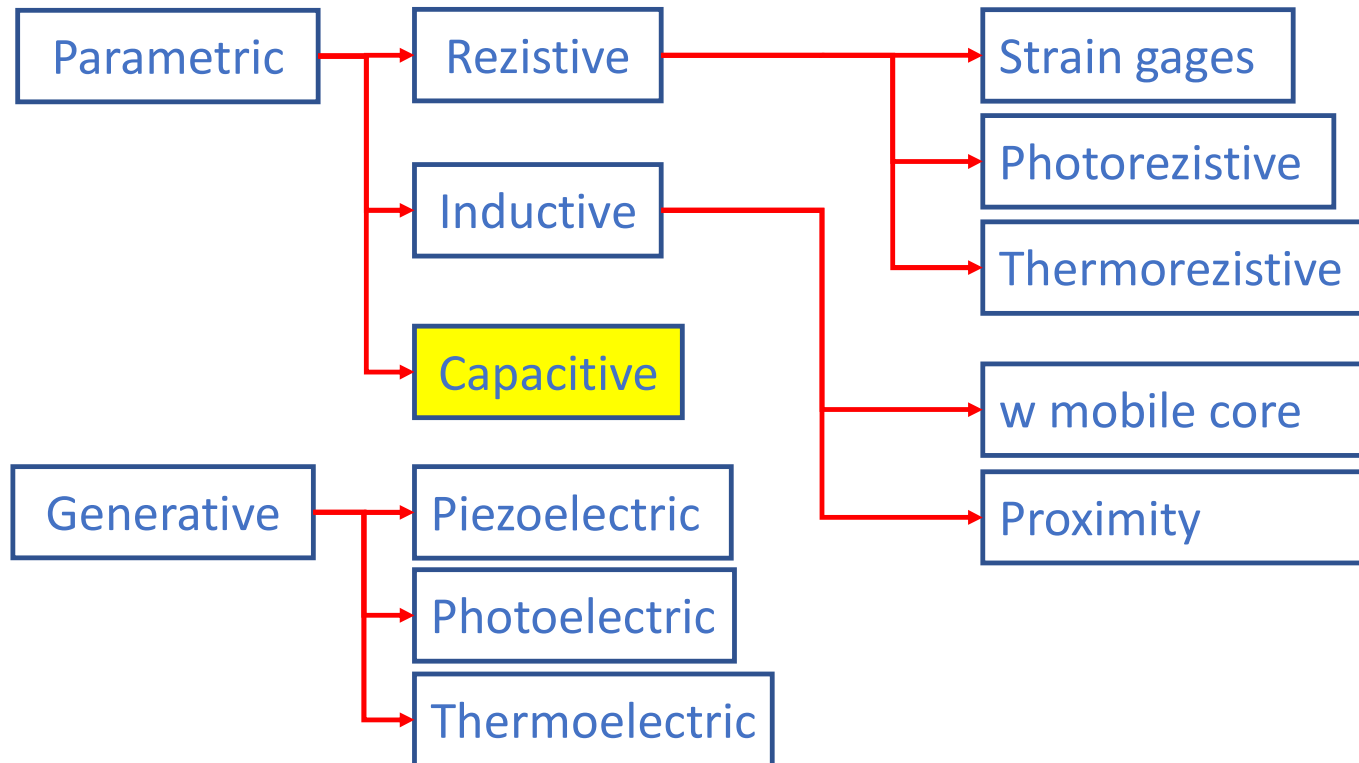
Inductive transducers



Proximity

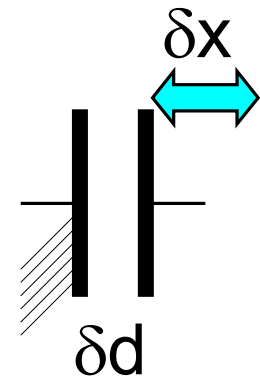
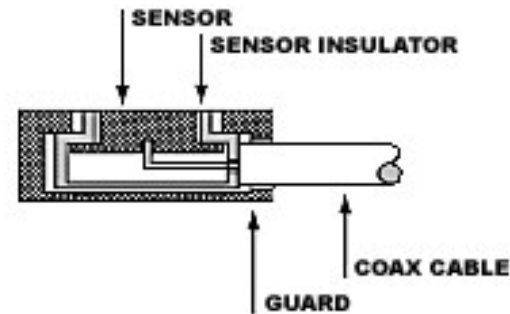
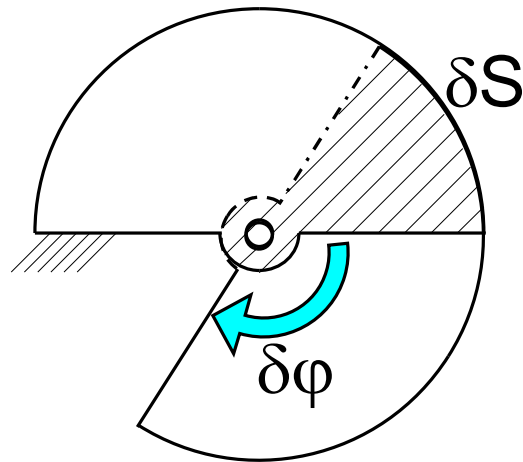
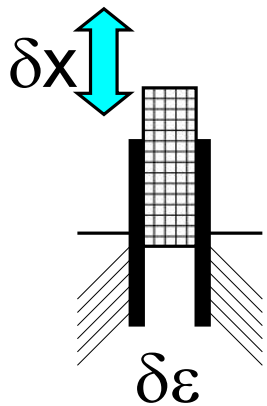


Transducers classification

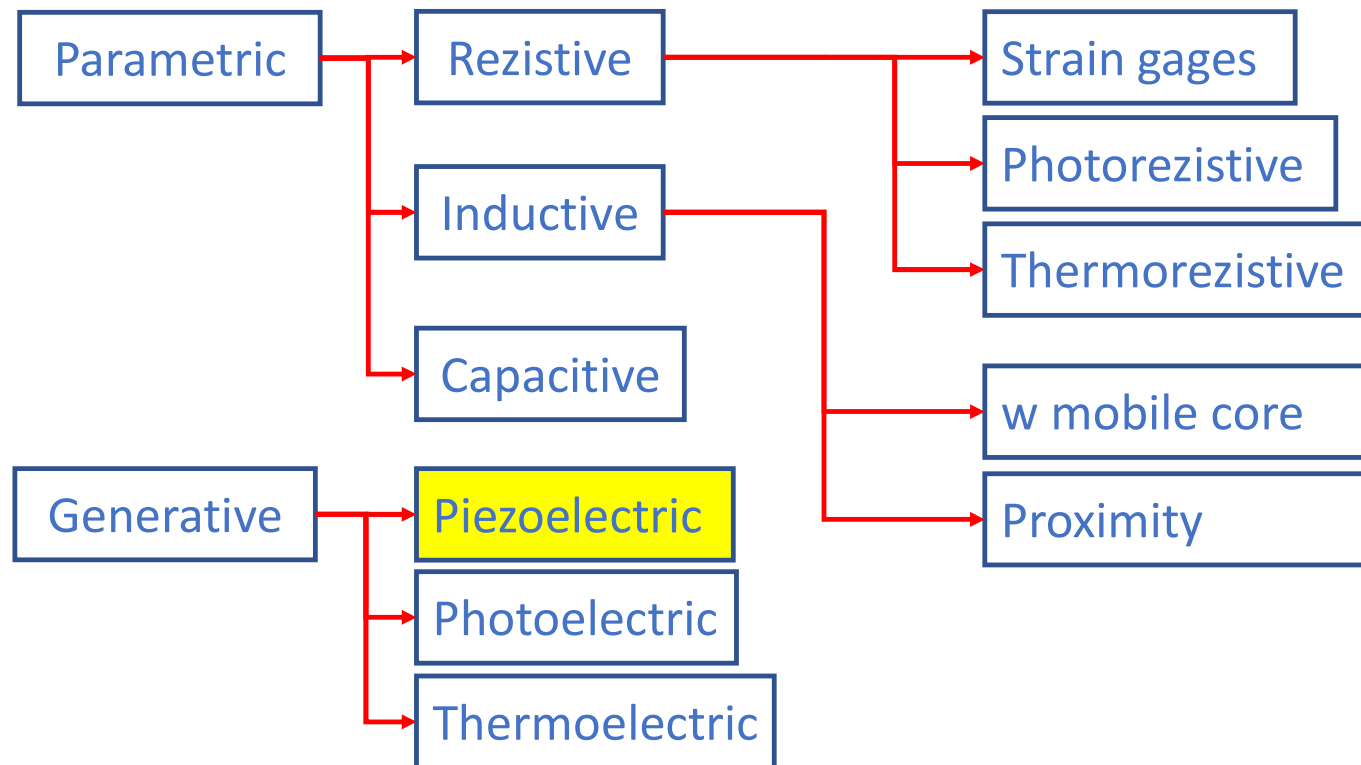


Capacitive transducers

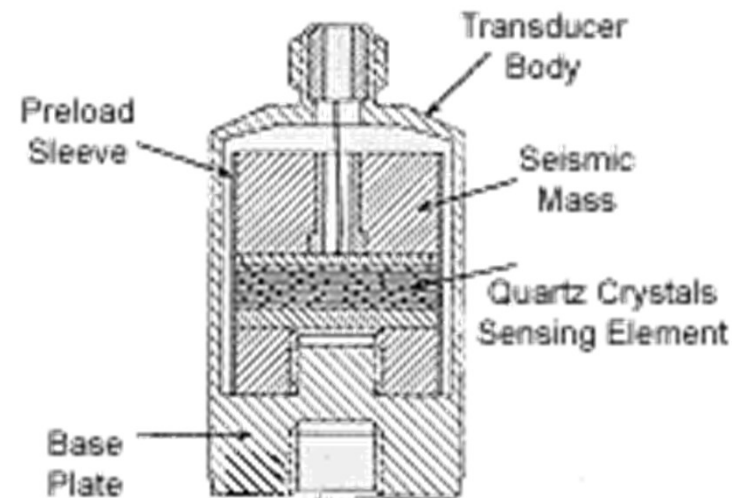
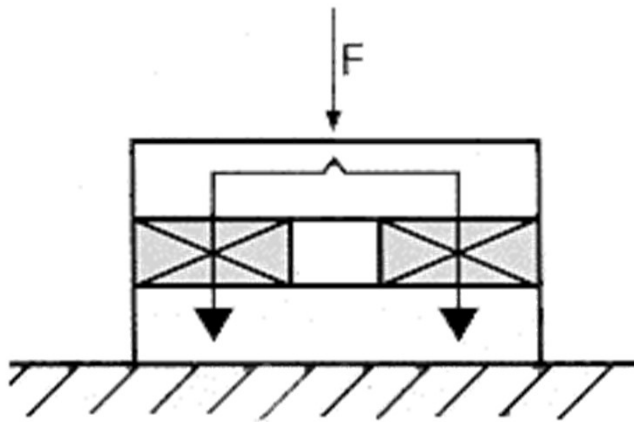
$$C = \frac{\epsilon \cdot S}{d}$$



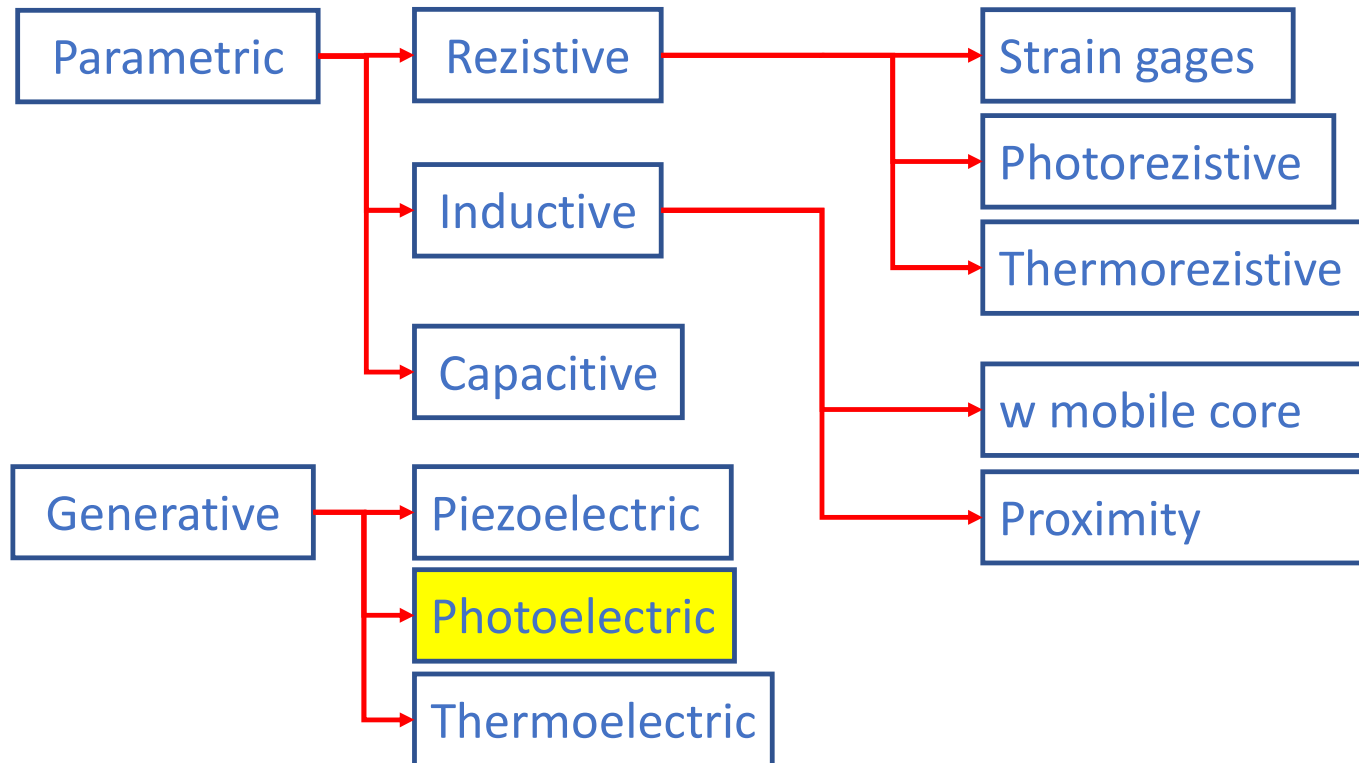
Transducers classification



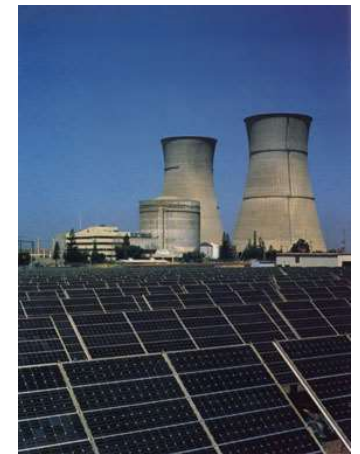
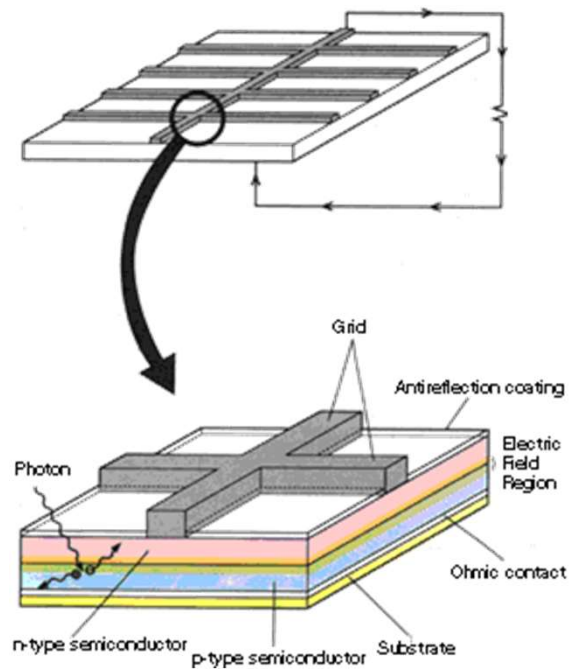
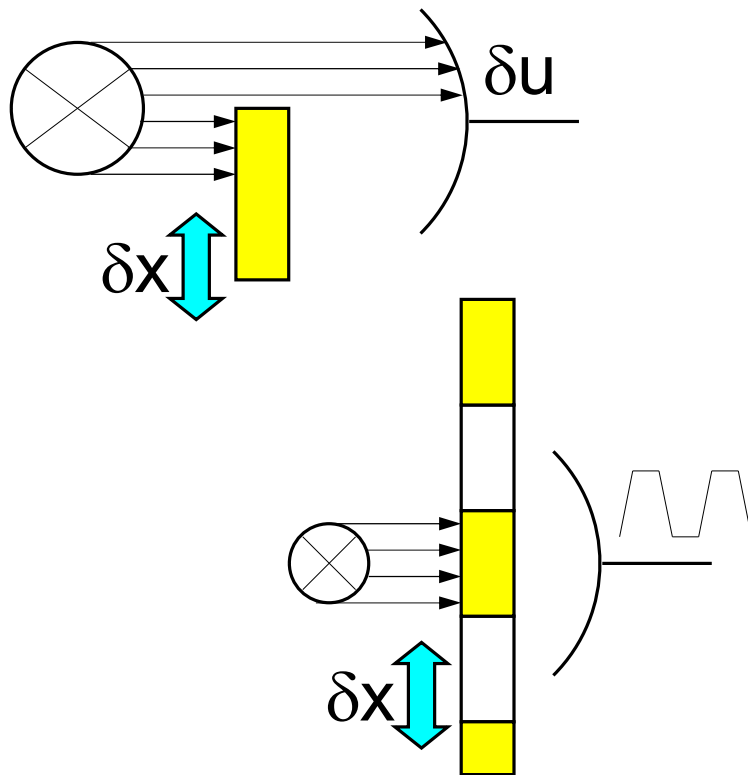
Piezoelectric transducers



Transducers classification



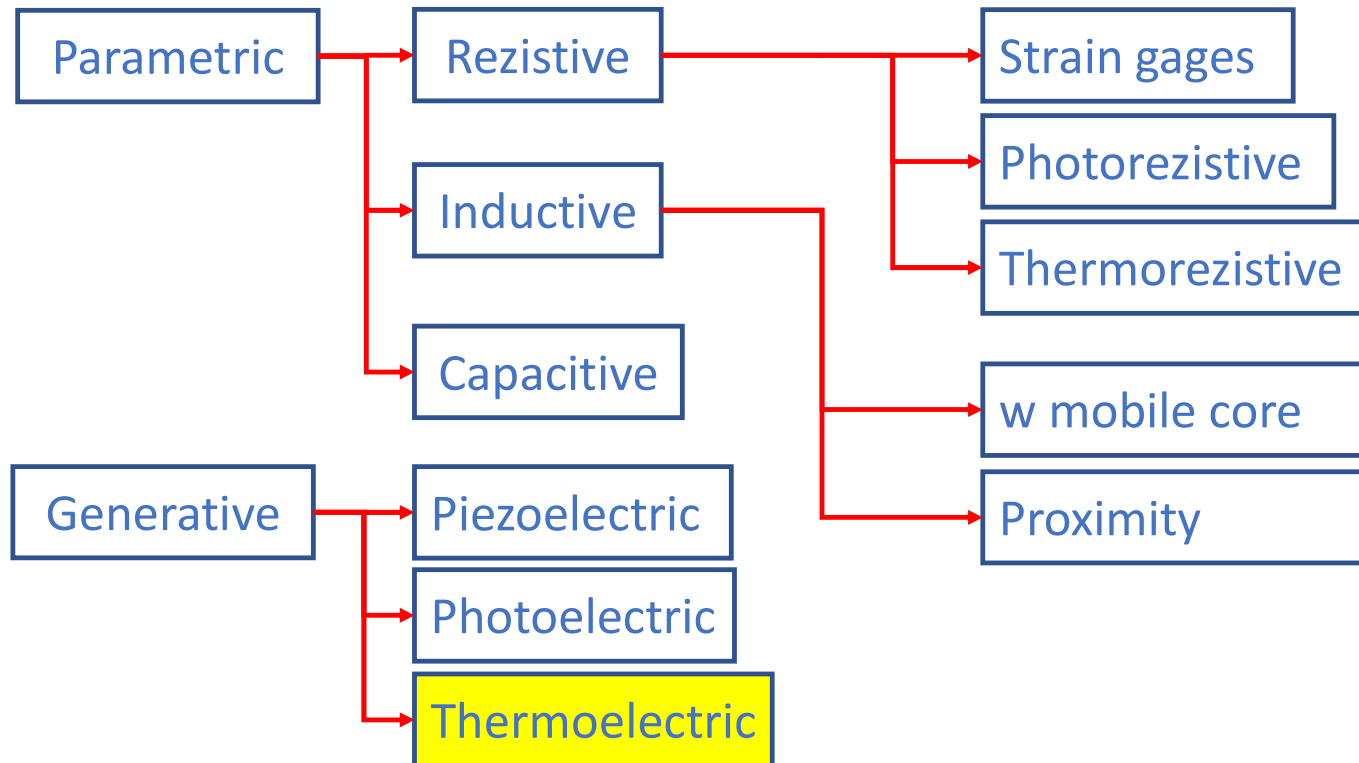
Photoelectric transducers



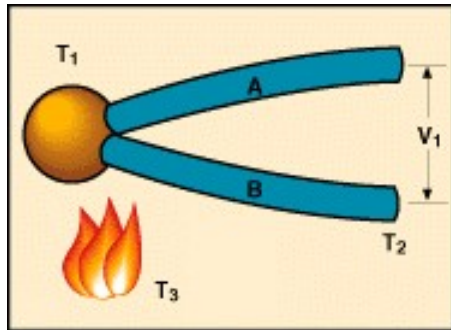
Co-funded by the Erasmus+ Programme of the European Union



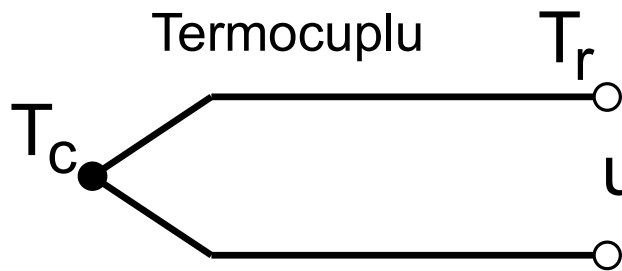
Transducers classification



Thermoelectric transducers



Termocuplu



$$u = \alpha \cdot (T_c - T_r)$$

