

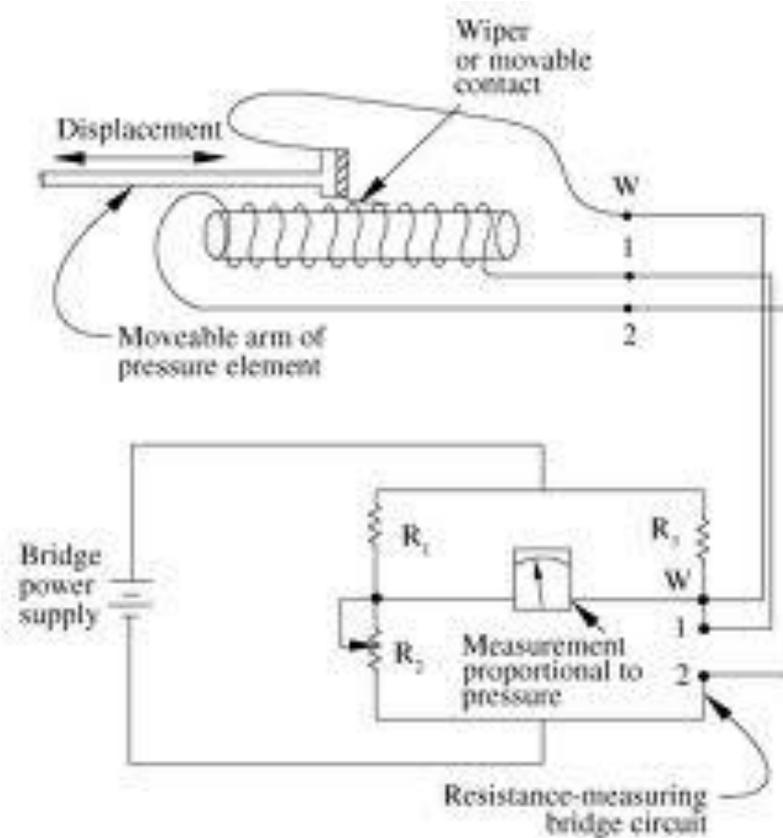
# **Lecture 13-14**

Transducers

# Transducer

- A **transducer** is a device that converts a signal in one form of energy to another form of energy.
- Energy types include (but are not limited to) electrical, mechanical, electromagnetic (including light), chemical, acoustic and thermal energy.
- While the term *transducer* commonly implies the use of a sensor/detector, any device which converts energy can be considered a transducer.
- Transducers are widely used in measuring instruments.

# Transducer



# Transducer

- A sensor is used to detect a parameter in one form and report it in another form of energy, often an electrical signal. For example, a pressure sensor might detect pressure (a mechanical form of energy) and convert it to electricity for display at a remote gauge.
- An actuator accepts energy and produces movement (action). The energy supplied to an actuator might be electrical or mechanical (pneumatic, hydraulic, etc.). An electric motor and a loudspeaker are both actuators, converting electrical energy into motion for different purposes.

# Types of Transducers

- Active Transducers
  - Which do not require any external power source  
e.g. Photovoltaic cell
- Passive Transducers
  - Which require external power source to work e.g.  
Electronic Thermometers, Potentiometric devices

# Types of Transducers

- Temperature – voltage (Thermocouple)
- Temperature – displacement (Thermometer)
- Temperature – Resistance change (Resistor T/M)
- Displacement – Inductance change (Diff T/F)
- Strain – Resistance Change (Strain Gauge)
- Music/Speech – Capacitance Chang(Condenser M/P)
- Light – Voltage (Lightmeter, Luxmeter)
- Light radiation – Current (Photomultiplier Tube)



**Compression**



**Bending Beam**



**Load cells**



**S-Beam**



**Canister Load Cells**



**Platform and Single Point**



**Single Point**



**Low profile**



**Single Point Water proof**



**Rotating Torque Sensor**



**Compression / Tension**



**Double Ended Shear Beam**



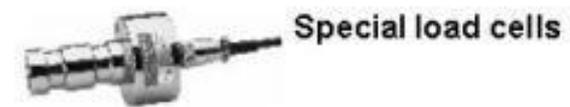
**Load cell + Accessories**



**Accessories**



**Single Ended Shear beam**



**Special load cells**



**Spoke Type**

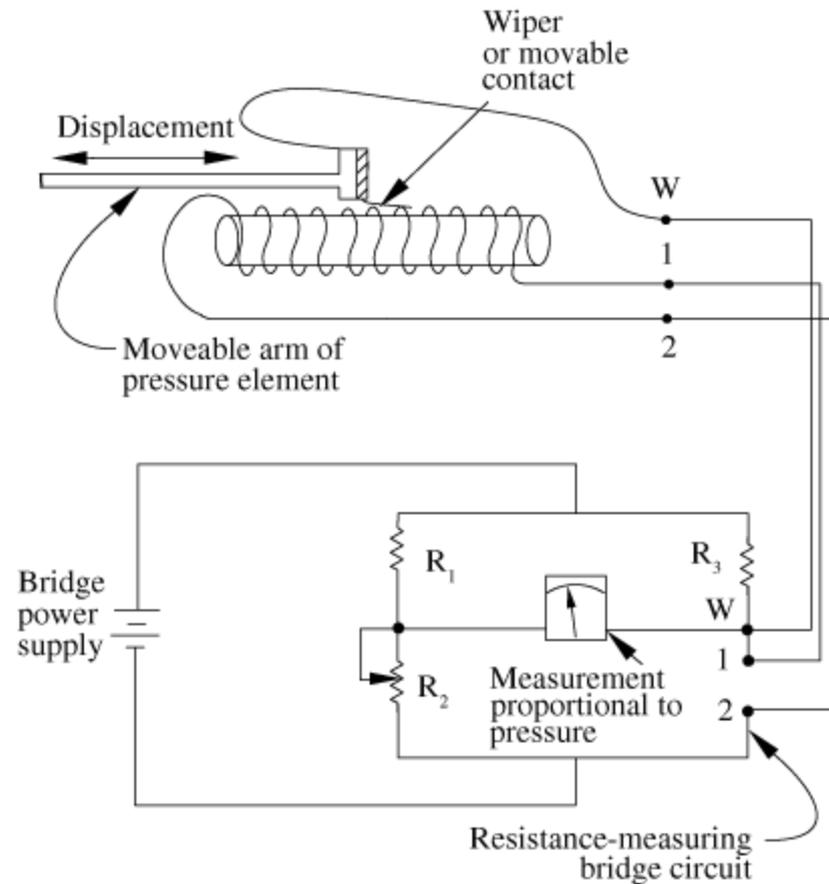


**Pressure cells**

**Raja Load Cell**

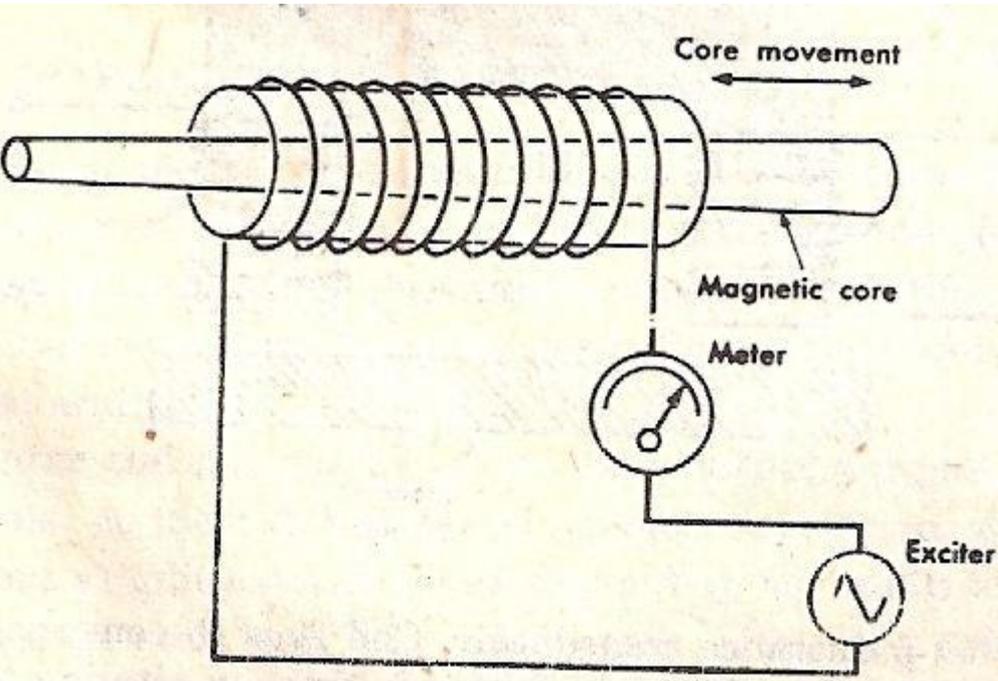
**TELP. 021-86603547**

# Resistance Transducer



# Inductance Transducer

- Self-Generating



- Non-self Generating

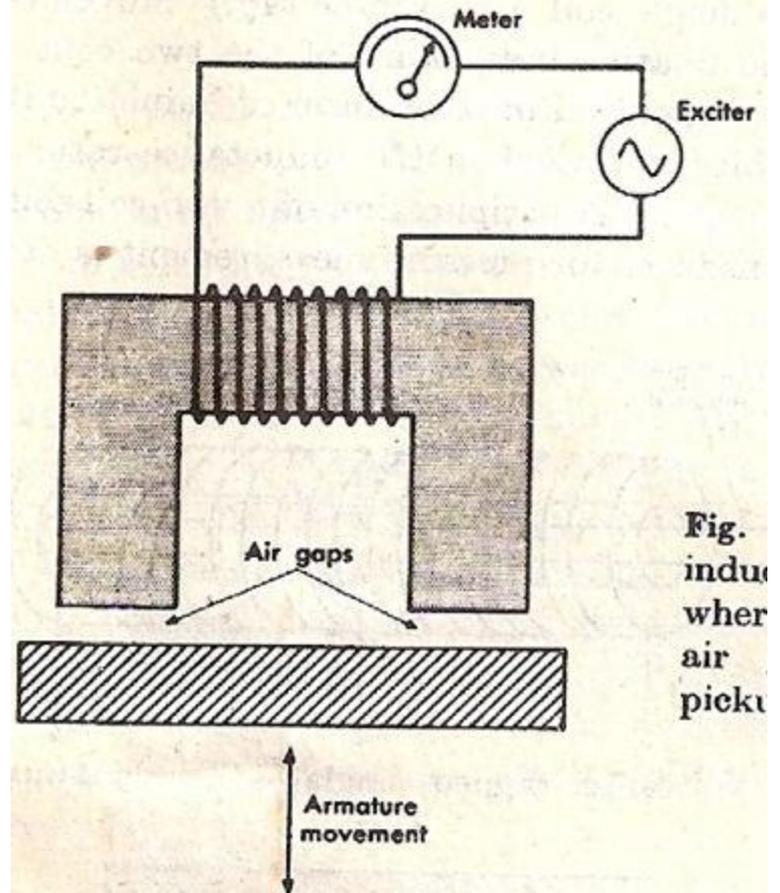
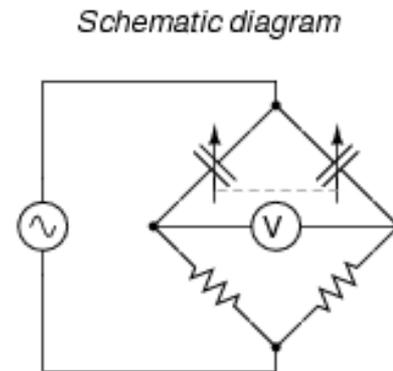
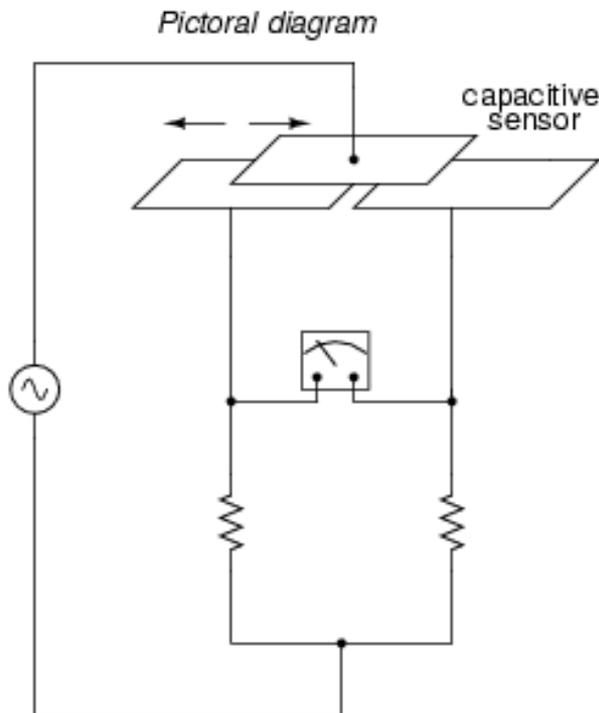


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# Capacitive Transducer

- $C = \frac{\epsilon A}{3.6\pi d}$

Go through Example of Book and Table 11.1 (Chapter 11)



# Temperature Measurement

- Thermo-resistive type
  - E.g. Resistance temp detectors RTD, Thermistors
  - Also called resistance thermometers
- Thermo-Electric type
  - E.g. Thermocouple

# Temperature Measurement

- Resistance Thermometers
  - For Platinum                      -300F to 1500F
  - For Copper                         -325F to 250F
  - For Nickel                         32F to 150F
- $R_t = R_{ref}(1 + \alpha\Delta t)$
  - Have a look at related examples in book

# Temperature Measurement

- Thermocouple
  - If two different elements are combined to form a joint a voltage is produced due to the junction
  - This voltage is the tens of millivolts at room temperature
- Parasitic Thermocouple
  - Undesired voltage produced due redundant junctions

# Temperature Measurement

- Thermocouple
  - If two different elements are combined to form a joint a voltage is produced due to the junction
  - This voltage is the tens of millivolts at room temperature
- Seebeck Effect
  - In 1821 Thomas Seebeck referred to it as Seebeck Effect

# Temperature Measurement

- Parasitic Thermocouple
  - Undesired voltage produced due redundant junctions/joints
  - Diagram

# Photosensitive Devices

- For detection of radiant energy or light
- 1) Vacuum type phototubes
- 2) Gas type type phototubes
- 3) Multiplier Phototubes
- 4) Photo-conductive tubes
- 5) Photo-voltaic cells
  
- Diagram

**Thank you**