RAMA UNIVERSITY

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FACULTY OF ENGINEERING AND TECHNOLOGY

MEMS-035

Lecture -02

There are two principal components of MEMs:

(1) A sensing or actuating element and a single transduction unit,

(2) MEMs as a Micro Sensor.

❖ Use the lithographic and other micro fabrication technologies to create miniaturized sensors, actuators, and structures.

❖ In fabrication processes, the addition, subtraction, modification, and patterning of materials are typically done using techniques originally developed for the integrated circuit industry.

❖ The most popular material used for MEMS is Silicon for it's semiconductor , physical and commercial properties.

❖ Micro-Electro-Mechanical Systems consists of mechanical elements, sensors, actuators, and electrical and electronics devices on a common silicon substrate.

❖ The sensors in MEMS gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and magnetic phenomena.

❖ The electronics then process the information derived from the sensors and through some decision making capability direct the actuators to respond by moving, positioning, regulating, pumping, and filtering, thereby controlling the environment for some desired outcome or purpose.

ADVANTAGES OF MEMS DEVICES

- .Very small size, mass, volume
- Very low power consumption
- Low cost
- Easy to integrate into systems or modify
- Small thermal constant
- Can be highly resistant to vibration, shock and radiation
- Batch fabricated in large arrays
- Improved thermal expansion tolerance
- Parallelism

TYPICAL APPLICATIONS

Applications are developed where miniaturization is beneficial

- Consumer products
- Aerospace
- Automotive
- Biomedical
- Chemical
- Optical displays
- Wireless and optical communications
- Fluidics

TYPES OF MEMS DEVICES

- Pressure sensors
- Accelerometers (inertial sensors)
- Micro-mirrors
- Gear Trains
- Miniature robots
- Fluid pumps
- Micro-droplet generators
- Optical scanners
- Probes (neural, surface)
- Analyzers
- Imagers

Pressure Sensor

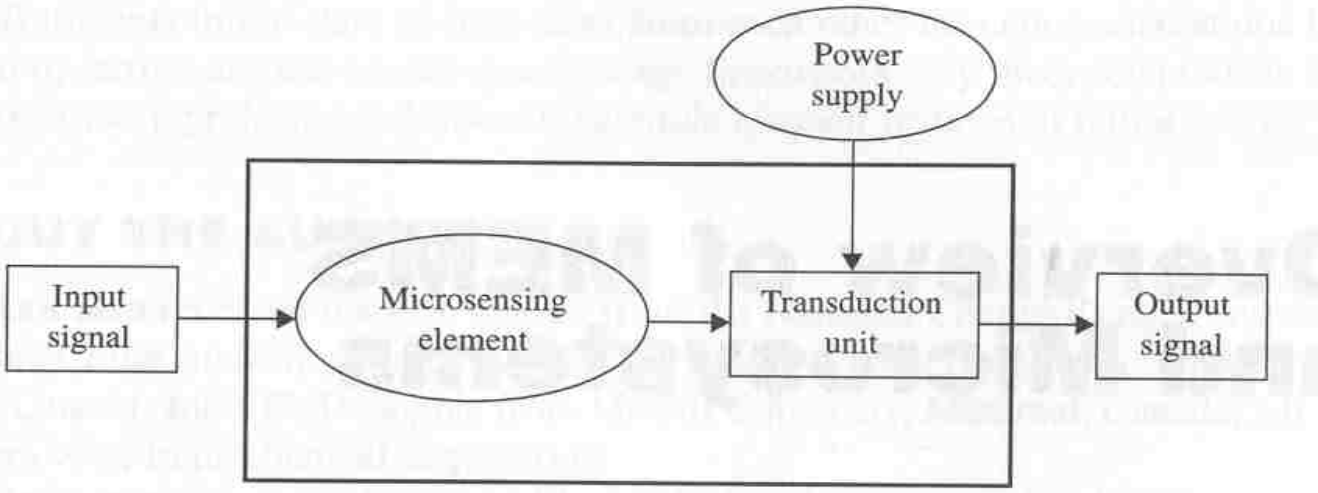
Input Signal: Pressure

Microsensing element: a Silicon Diaphragm

Transduction unit: Piezoresistors (for resistance change), plus a Wheatstone bridge circuit

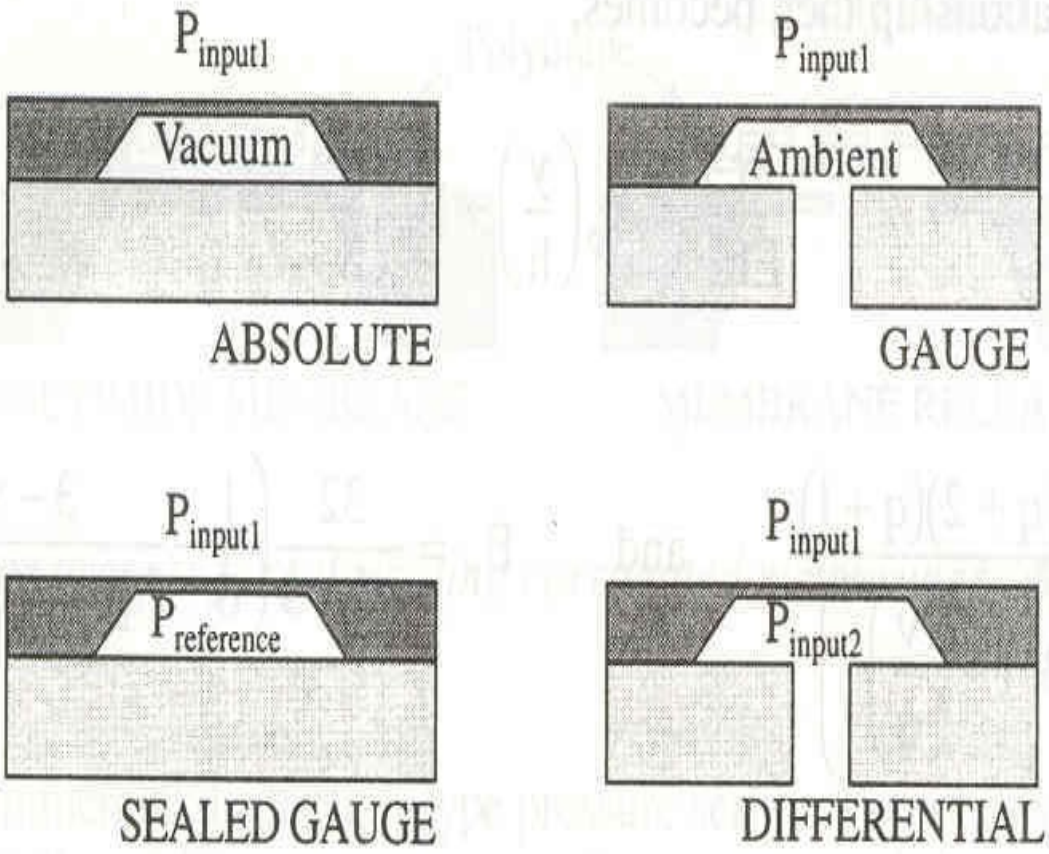
Output Signal: Voltage change

Figure 1.1 I MEMS as a microsensor.



AN ANEROID PRESSURE SENSOR:

The basic operating principle is to couple the pressure to-be measured to one surface of a membrane and to measure its deflection (knowing the pressure-to- deflection transfer function).



Types of pressure sensor designs commonly implemented in micromachined form. After Bryzek, et al. (1991).