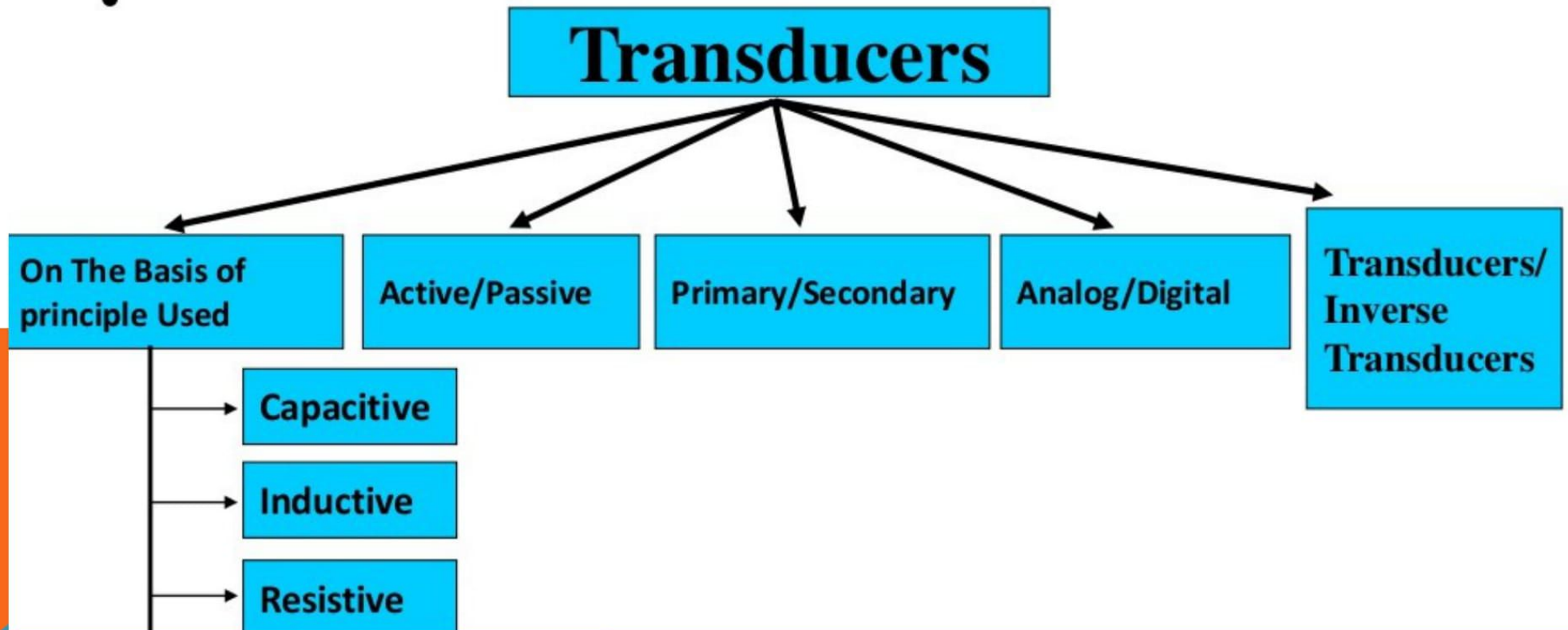


TRANSDUCERS AND SENSORS

DSE4.1 INTRODUCTION

CLASSIFICATION OF TRANSDUCERS:-

CLASSIFICATION OF TRANSDUCERS ARE BASE ON METHOD OF ENERGY CONVERSION, APPLICATION, NATURE OF OUTPUT SIGNAL AND SO ON



- **TRANSDUCER DESCRIPTIONS**

- **A Transducer is a device which converts one form of energy into another form.**
- **Alternatively, a Transducer is defined as a device which provides usable output response to a specific input measured which may be a physical quantity.**
- **A Transducer can also be defined as a device when actuated by energy in one system supplies energy in the same form or in another form to a second system.**

PARAMETERS FOR SELECTING TRANSDUCERS

SENSITIVITY: THE SYSTEM MUST BE SENSITIVE TO ANY CHANGE IN THE INPUT APPLIED TO IT. A SENSITIVE SYSTEM WILL PROVIDE ACCURATE RESULTS AT THE OUTPUT.

ACCURACY: ACCURACY OF THE SYSTEM IS THE ABILITY TO GENERATE PROPER OR ERRORLESS RESULTS. THE UNIT MUST BE PROPERLY CALIBRATED IN ORDER TO GENERATE ACCURATE RESULTS.

OPERATING RANGE: OPERATING RANGE MUST BE PROPERLY CHOSEN IN ORDER TO HAVE ERRORLESS RESULTS. ALSO, THE RANGE MUST BE SELECTED ACCORDING TO THE INSTRUMENTATION SYSTEM. ITS OPERATING RANGE MUST BE HIGH SO THAT IT CAN OPERATE UP TO A LARGE RANGE.

RUGGEDNESS: THE SYSTEM MUST BE RUGGED IN TERMS OF ITS USAGE. AS IT MUST BE RUGGED ENOUGH TO HANDLE HIGH ELECTRICAL AS WELL AS MECHANICAL INTENSITIES.

LINEARITY: THE INPUT AND OUTPUT CHARACTERISTIC OF ANY TRANSDUCER MUST BE LINEAR IN ORDER TO HAVE DESIRED RESULTS.

REPEATABILITY: A TRANSDUCER SHOULD GENERATE A REPEATEDLY SAME OUTPUT WHEN SAME INPUT IS APPLIED AT ITS TERMINALS.

ELECTRICAL PARAMETERS: ELECTRICAL PARAMETERS OF THE SYSTEM MUST BE PROPERLY SELECTED. THIS RELATES IN TERMS OF SNR AT THE TIME OF AMPLIFICATION OF THE SIGNAL, ITS FREQUENCY RESPONSE AND REQUIRED CABLE LENGTH ETC.

DYNAMIC RANGE: THIS IS THE RATIO BETWEEN THE LARGEST AMPLITUDE SIGNAL AND THE SMALLEST AMPLITUDE SIGNAL THE TRANSDUCER CAN EFFECTIVELY TRANSLATE.^[2] TRANSDUCERS WITH LARGER DYNAMIC RANGE ARE MORE "SENSITIVE" AND PRECISE.

REPEATABILITY: THIS IS THE ABILITY OF THE TRANSDUCER TO PRODUCE AN IDENTICAL OUTPUT WHEN STIMULATED BY THE SAME INPUT.

NOISE: ALL TRANSDUCERS ADD SOME RANDOM NOISE TO THEIR OUTPUT. IN ELECTRICAL TRANSDUCERS THIS MAY BE ELECTRICAL NOISE DUE TO THERMAL MOTION OF CHARGES IN CIRCUITS. NOISE CORRUPTS SMALL SIGNALS MORE THAN LARGE ONES.


HYSTERESIS: THIS IS A PROPERTY IN WHICH THE OUTPUT OF THE TRANSDUCER DEPENDS NOT ONLY ON ITS CURRENT INPUT BUT ITS PAST INPUT. FOR EXAMPLE, AN ACTUATOR WHICH USES A GEAR TRAIN MAY HAVE SOME BACKLASH, WHICH MEANS THAT IF THE DIRECTION OF MOTION OF THE ACTUATOR REVERSES, THERE WILL BE A DEAD ZONE BEFORE THE OUTPUT OF THE ACTUATOR REVERSES, CAUSED BY

INTRODUCTION FOR MICROSENSORS

MICROSENSOR. ‘

A VERY SMALL SENSOR WITH PHYSICAL DIMENSIONS IN THE SUBMICROMETER TO MILLIMETER RANGE.

A SENSOR IS A DEVICE THAT CONVERTS A NONELECTRICAL PHYSICAL OR CHEMICAL QUANTITY, SUCH AS PRESSURE, ACCELERATION, TEMPERATURE, OR GAS CONCENTRATION, INTO AN ELECTRICAL SIGNAL.



HISTORY OF MICROSENSORS

FOR INSTANCE, THE TEMPERATURE SENSITIVITY OF ELECTRICAL RESISTANCE IN A VARIETY OF MATERIALS WAS NOTED IN THE EARLY 1800S AND WAS APPLIED BY WILHELM VON SIEMENS IN 1860 TO DEVELOP A TEMPERATURE SENSOR BASED ON A COPPER RESISTOR.

- **Miniaturization.**
- **Miniaturization, low weight, and low volume are as important in medical electronics as in space electronics and other applications.**
- **The small size and weight are benefits of hybrid microcircuits; they have been used for a long time in pacemakers and defibrillators.**

- **SCALING LAW**
- **They allow us to determine whether physical phenomena will scale more favorably or will scale poorly.**
- **Generally, smaller things are less effected by volume dependent phenomena such as mass and inertia, and are more effected by surface area dependent phenomena such as contact forces or heat transfer**