Structural Health Monitoring (SHM)
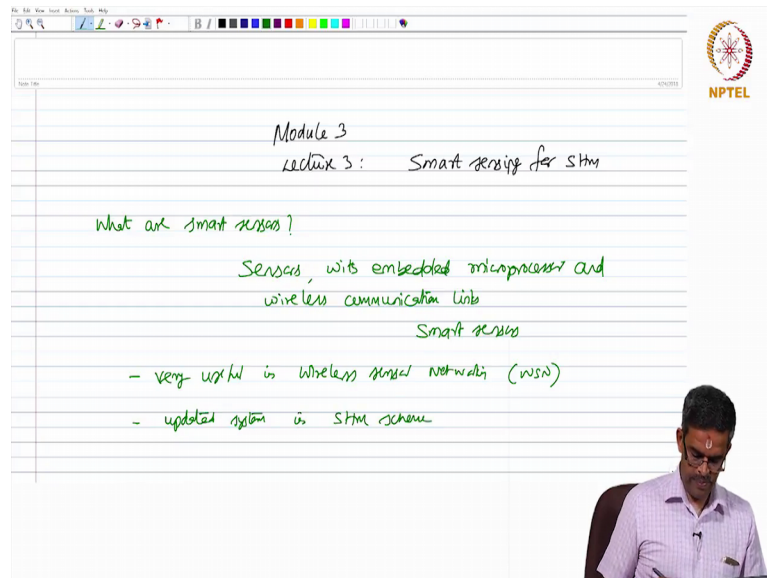**Prof. Srinivasan Chandrasekaran**
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Lecture - 48
Smart sensing for SHM - Part 1

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Welcome to the module 3, lecture 3; where we will talk about Smart sensing for Structural Health Monitoring. The first foremost question comes what are smart sensors? Sensors, with embedded micro process and wireless communication links are called smart sensors.

Smart sensors are very useful in wireless sensor networking. This is the most updated system in Structural Health Monitoring scheme.

Let us ask another question. What are the advantages smart sensors?

It has an ability to continuously monitor the integrity of the structure in real time and can provide improved safety to the public, particularly in case of aging structures. For example, let us say bridges.

The second advantages; it has an ability to detect damage at an early stage, which can then reduce the cost of repair and also reduce the shutdown time of the structure.

Thirdly, it is helpful in predicting or observing initiation of damage or any other undesirable behavior of the structure. For example, settlement of supports, fatigue formation etcetera.

Therefore, they can be helpful to generate advance warning of removal of the structure or making it in operational due to safety regulations. So, essentially it can prevent serious disasters which are actually structural damages.

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Now, smart sensors more or less are wireless. Let us compare them with wired sensors. In conventional wired sensors there are many number of wires. Sometimes there can be fibre optic cables or physical transmission medium which may be a problem; becomes a serious issue in case of long-span bridges or tall buildings.

On the other hand, wireless sensors have low cost and densely distributed network.

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There are rapid advances which happened wireless sensors like wireless communications, micro-electro mechanical systems which is MEMs. People also use advanced information technology to enhance the structural health monitoring quality. Sensors are also available nowadays with self calibration, self diagnosis, capabilities.

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If you look at the architectural design of sensors; essentially sensors have three components. Namely, the sensing element, signal condition and processing and the third

component is a sensor interface. Sensing element essentially consists of a resister, a capacitor, a piezo-electric module and photo diode etcetera.

Signal conditional processing consists of amplifiers or amplification, linearization, compensation and filtering. Sensor interface consists of wires, plugs, sockets to communicate with other electronic components.
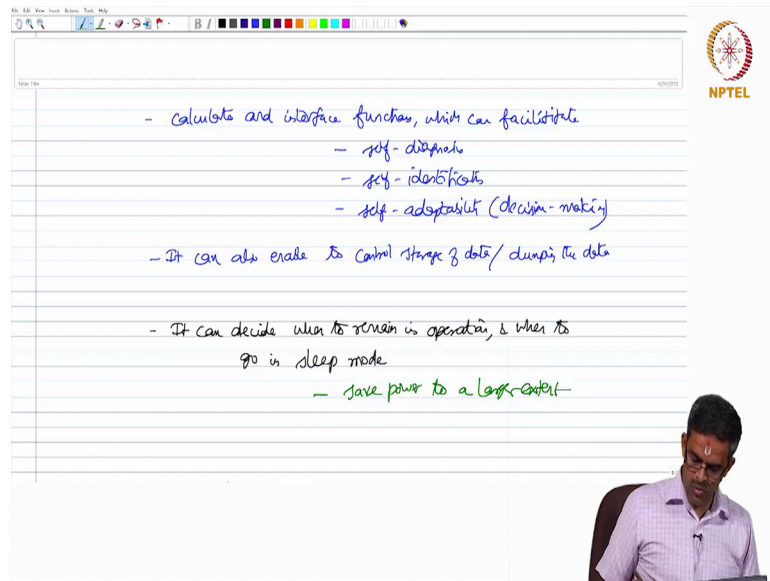
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So, there is an essential difference between the smart sensor and the conventional sensor. Let us see what is the difference? The essential difference is smart sensors have micro-processor on board, makes them intelligent. Let us see how?

Microprocessors can perform the following functions, digital processing, analog to digital converter ADC or frequency-code converter.

They can also calculate and interface functions which can facilitate self-diagnosis, self-identification and self-adaptability; that is they can be also useful to some extent on decision making. It can also enable to control storage of data or dumping the data.

More importantly, it can decide when to remain in operation and when to go in sleep mode. So, this can save power to larger extent. So, presence of micro processes makes the sensor intelligent in many ways.