

Structural Health Monitoring (SHM)
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Lecture - 49
Smart sensing for SHM -Part 2

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MEMS sensors

- manufactured using Very large scale Integration technology (VLSI)
- leads to manufacturing sensors in large Qty, reduces cost of sensors

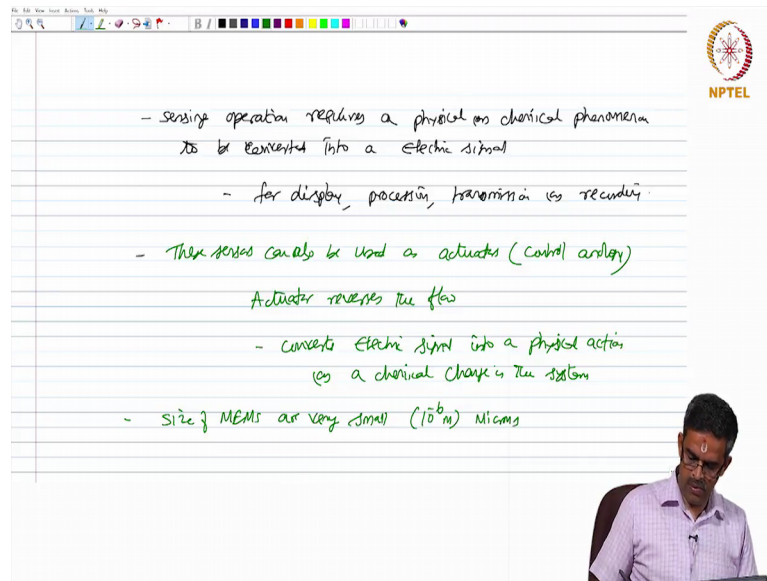
MEMS - 50 us\$

- These sensors perform integration of mech and electrical functions

If you look at MEMS sensors, slightly more in detail: MEMS sensors are manufactured using very large scale integrating technology which we call as VLSI.

The advantages; this leads to manufacturing sensors in large quantity and it reduces the cost of the sensors. MEMS sensors are as cheap as 50 US dollars. These sensors perform integration of mechanical and electrical functions.

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- sensing operation requires a physical or chemical phenomenon to be converted into a electric signal

- for display, processing, transmission or recording

- These sensors can also be used as actuators (control analogy)

Actuator reverses the flow

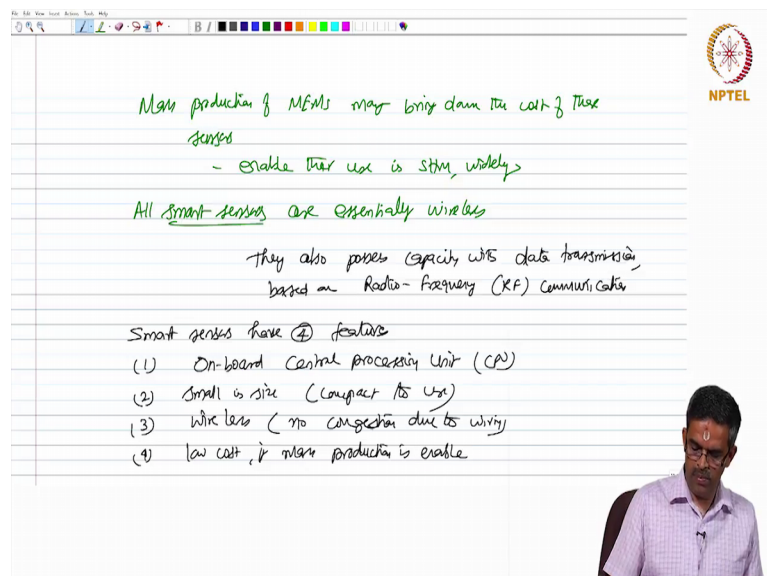
- converts electric signal into a physical action or a chemical change in the system

- size of MEMS are very small (10^6 m) microns

We all do agree that sensing operation requires a physical or a chemical phenomena to be converted into an electrical signal.

This is useful for display, processing, transmission or even let us say recording. Alternatively, these sensors can also be used as actuators in terms of control analogy. Actuators, actually reverses this flow. It converts electric signal into a physical action or a chemical change in the system size of MEMS sensors are very small. It is about 10 power minus 6 meters which are microns.

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Mass production of MEMS may bring down the cost of these sensors

- enable their use is still, widely

All smart sensors are essentially wireless

They also possess capacity with data transmission based on Radio-Frequency (RF) communication

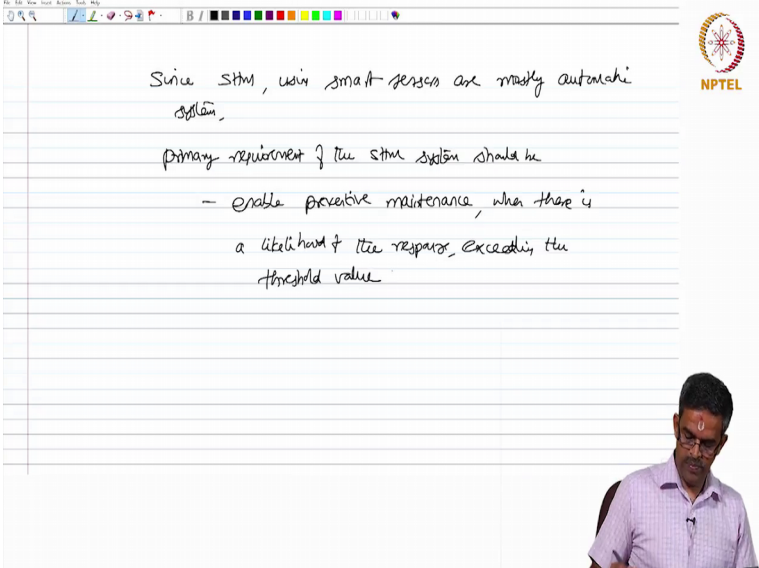
Smart sensors have 4 features

- (1) On-board Central processing Unit (CPU)
- (2) Small in size (compact its use)
- (3) wire less (no congestion due to wiring)
- (4) low cost, if mass production is enable

It is interesting to note that mass production of these sensors may bring down the cost of the sensors and enable their use in structural health monitoring very widely. All sensors are essentially wireless, if they are to be categorized as smart sensors.

So, they also possess capacity with data transmission based on Radio-Frequency that is called RF communication. Smart sensors have 4 features. One, they have On-board central processing unit. They are very small in size. So, I should say compact to use and they are wireless. So, no congestion due to wiring and they have low cost if mass production is enabled.

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Since SHM, using smart sensors are mostly automatic system,

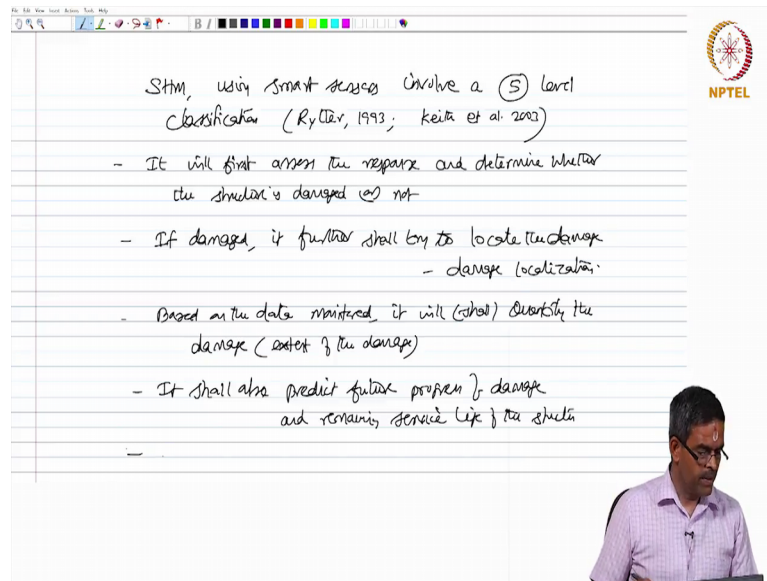
Primary requirement of the SHM system should be

- enable preventive maintenance, when there is a likelihood of the response, exceeding the threshold value.

Now, since structural health monitoring, using smart sensors or mostly automatic systems, the primary requirement of such system should be enable preventive maintenance because the system is being maintained automatically without any physical warning.

Therefore, there should be a caution of preventive maintenance, when there is a likelihood and the response, exceeding the threshold value.

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The slide contains the following handwritten text:

SHM, using smart sensors involve a 5 level classification (Rytter, 1993; Keira et al. 2003)

- It will first assess the response and determine whether the structure is damaged or not
- If damaged, it further shall try to locate the damage - damage localization
- Based on the data monitored, it will (shall) quantify the damage (extent of the damage)
- It shall also predict future progress of damage and remaining service life of the structure

The slide also features the NPTEL logo in the top right corner and a small inset video of a man in a purple shirt speaking in the bottom right corner.

The structural health monitoring using smart sensors involve a 5 level classification. It will first assess the response and determine whether the structure is damaged or not. If damaged, it further shall try to locate the damage. This is what we call damage localization.

Based on the data observed or monitored, it will and it shall quantify the damage. There is how extent the damage has occurred and what would be the consequence of that? It shall also predict the future progress of damage and the remaining service life of the structure.

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- It should recommend appropriate remedial/repair measures to restore both strength and functionality of the structure.

SHM - using smart sensors

- offers a complete solution for safety and healthy functionality of the structure.

Finally, it should recommend appropriate remedial measure or repair measures to restore both strength and functionality of the structure.

So, structural health monitoring using smart sensors offer a complete solution for safety and healthy functionality of the structure.

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Summary

- Smart Sensing
- requirements of smart sensor
- adv of smart sensor is SHM
- wireless is comparison to wired sensor
- SHM - smart sensors, 5 steps process SHM should address.

So friends, in this lecture, we learnt about the smart sensing. What are the requirements of smart sensors; what are the advantages of using smart sensors in SHM? What are the advantages of making the sensors wireless in comparison to wired sensor networking and

if an SHM has smart sensors, what would be the 5 stage process and SHM should address to offer a complete protection to the structure.

We will continue the discussion on smart sensors in the next lecture as well.

Thank you very much and bye.