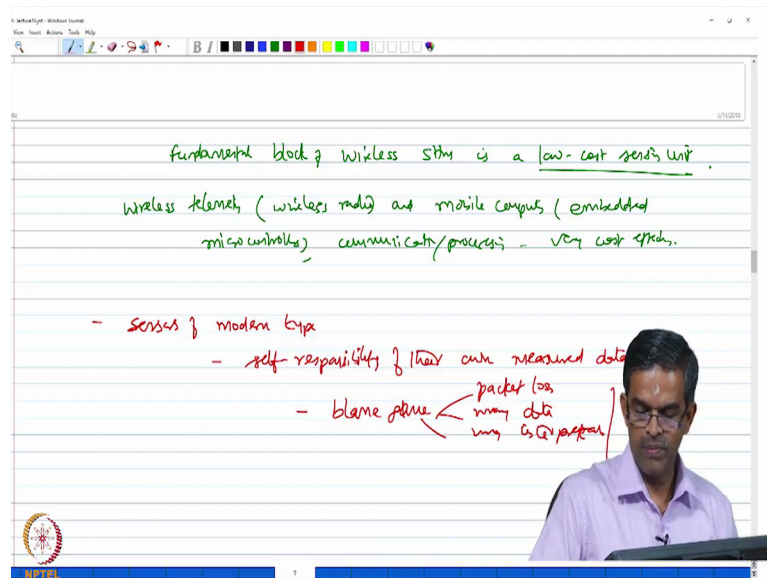


Structural Health Monitoring (SHM)
Prof. Srinivasan Chandrasekaran
Department of Ocean Engineering
Indian Institute of Technology, Madras

Lecture - 84
Part - 2: Future Scope of SHM

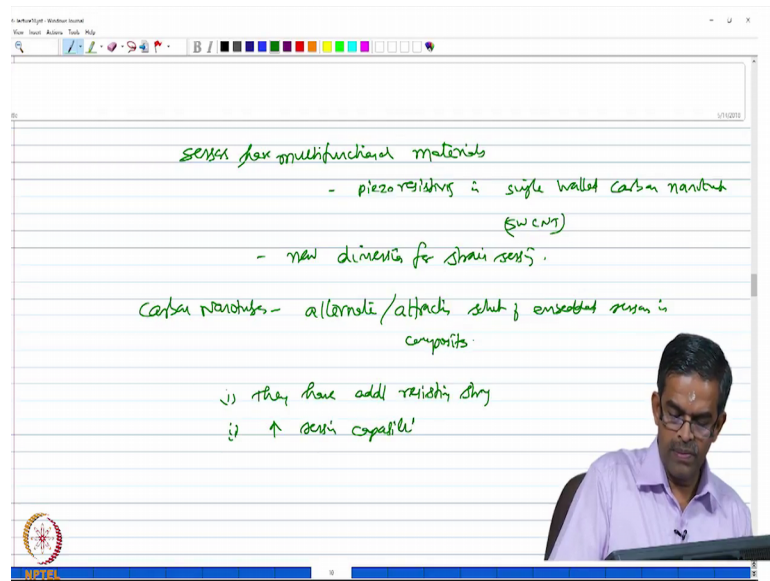
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Now, one can also say the fundamental block of wireless structural health monitoring is a low cost sensing unit. For example, using wireless telemetry that is wireless radios and mobile computing; that is using embedded microcontrollers, the communication and processing have become very cost effective. Most importantly sensors of the modern type have the capacity to take self responsibility of their own measured data.

So, the blame game of packet loss, wrong data, wrong interpretation has all stopped since has become more responsible these days.

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Sensors from multifunctional materials

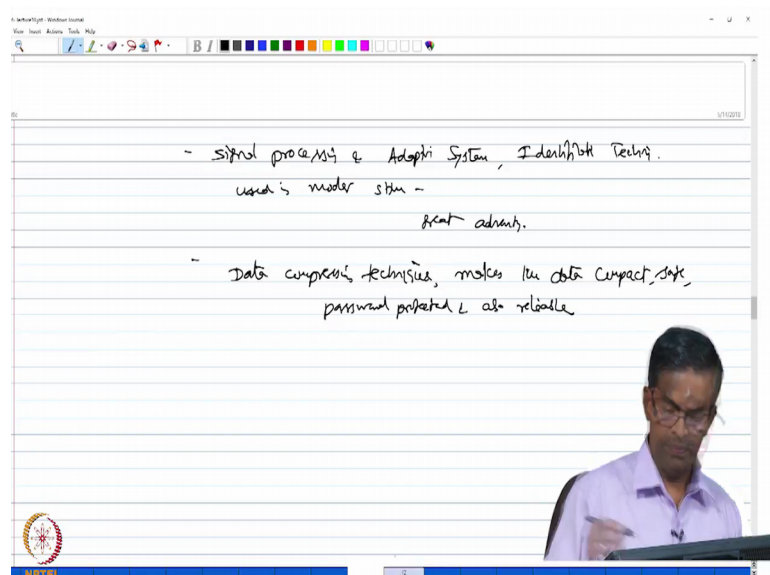
- piezo-resistive in single walled carbon nanotube (SWCNT)
- new dimension for strain sensing.

Carbon nanotubes - alternate/attach, substitute & embedded sensor in composites.

- i) they have additional resisting strength
- ii) ↑ sensing capabilities

To say so, there are sensors which has multifunctional materials which uses piezo resistivity in single walled carbon nanotubes. That is single walled carbon nanotubes has a new dimension for strain sensing; the carbon nanotubes has an alternate and attractive solution of embedded sensors in composites. So, the advantage of this could be; they have additional resisting strength and as well as they have high sensing capabilities.

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- signal processing & Adaptive System, Identification Technique.
- user's model system -
plant outputs.
- Data compression techniques, makes the data compact, safe, password protected & also reliable

And adaptive system which is one of the major identification technique used in modern SHM is a great advantage. Now, these have data compression technique which makes the data compact safe, password protected and also reliable.

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Sensors

- measure damage, even @ very low scale
- long-term data duration

Fault detection & Control

offers the ability to control system

- designed with an integrated hardware of sensors
- ↑ reliability

There are sensors which can measure damage even at a very low scale and in the long term data duration. Further, fault detection and control offers the ability to control systems which is designed with an integrated hardware of sensors with high reliability.

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post-processing of the measured data

finite Element Model updates

- necessary to choose a proper FEM model to simulate the damage (probulated failure cases)
- form a bench mark value for the Control Strategy

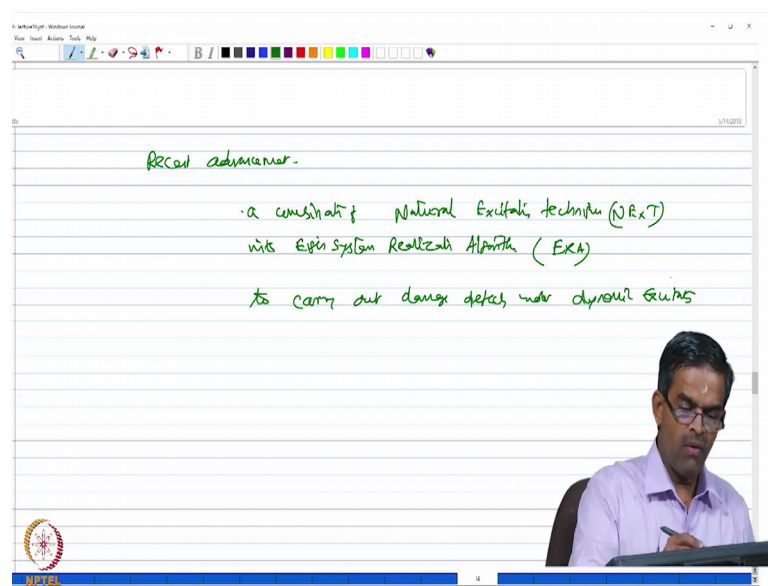
- advanced sensor patch technology

- uniform distribution (within distributed)
- no work even

Further, in post processing of the data; finite element model updates plays a very important role, it is important and necessary to choose a proper FCA model to simulate; the damage what we call as postulated failure and then form a benchmark value for the control strategies. The next issue which is also advanced is the sensor placing technology.

This ensures uniform distribution of sensors or I should say at least uniform distribution of measurement; it also ensures low cost and compatibility.

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The recent advancement in us which is the combination of natural excitation technique which is called as next with eigen system realization algorithm, which is ERA is one of the recent features to carry out damage deduction under dynamic excitations.

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Common problem
Effect of environmental conditions on sensor performance

Principal Component Analysis (PCA)
- multi-variate statistical model that can reduce the effect of environmental factors on the sensor
- humidity
- temperature etc

However, very interestingly a common problem which is generally argued upon for the unsuccessfulness of SHM is the effect of environmental conditions on sensor performance. Even this issue is answer people have started using principle component analysis which is PCA, which is a multi various statistical model that can reduce the effect of environmental factors such as humidity, temperature etcetera on the sensor performance.

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large size file information

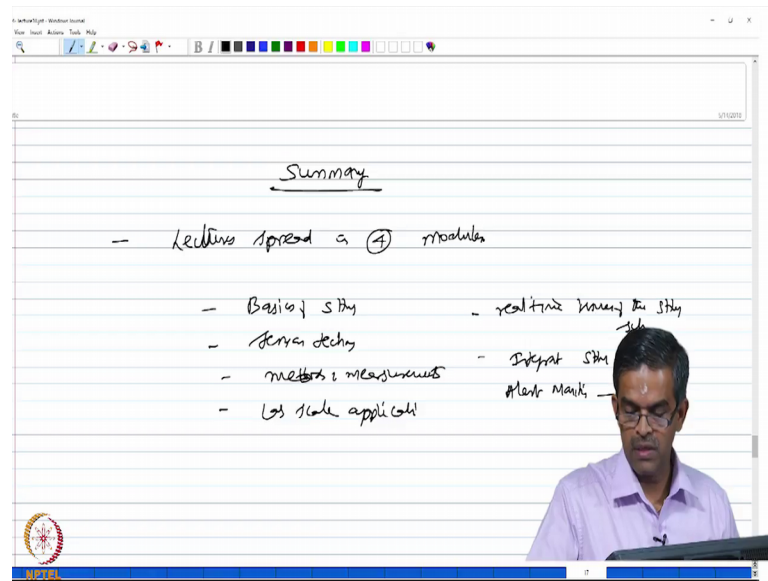
* distributed health monitoring system

- excessive strain
- defects etc
- load distribution (temp variation)

maintenance (lay-up bags)

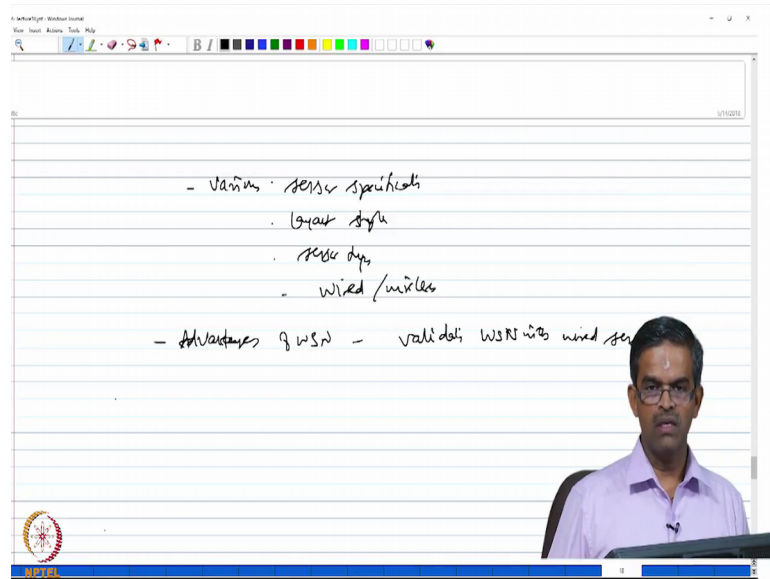
The next challenge could be large size of the infrastructure. Let us say long bridges, tunnels etcetera. Now this can be also answered by using distributed health monitoring system which can be used to measure the excessive strain, deflections and load distributions caused due to temperature variation, settlement of foundation etcetera on the structures on a long term basis.

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So friends, we have discussed the whole course, lecture spread in 4 modules. We talked about the basics of structural health monitoring, sensor technologies, then the method measurements, lab scale applications, real time issues of the health monitoring scheme, then integrating health monitoring with alert monitoring to manage the disaster prevention.

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We have also discussed various sensor specifications, layout style, sensor type applied to both wired and wireless. And we have discussed about the advantages of wireless sensor networking after validating the WSN with wired sensors.

I hope you have understood and enjoyed all the set of lectures in 4 modules with which we will be completing this course with this particular lecture in fourth module. Each module has been submitted with lot of tutorials exercises for your betterment and understanding. Kindly post your queries and information's required for more learning through announcement forum, discussion forum in the portal of NPTEL IIT, Madras. I will personally attend to these questions and try to answer them with my interactive teams which are completely working dedicatedly on health monitoring systems; especially in the lab scale and a few attempts are also made to apply them on a real time monitoring scale.

Thank you again, and thank you for your consistence support and attending all the lectures and participating in all tutorials and enjoying the coursework which we did through this particular structural health monitoring course at NPTEL IIT, Madras. All your queries can be posted to Dr Sekaran at iit m dot ac dot in which is my email id at IIT, Madras I will be personally attending to all the questions back along with my team and try to support you literally and completely through and through for your tutorials and for the entire course.

Do help and entertain your friends and consulting engineers to pass on the benefit of this course contents to all of them. And try to write to me personally any improvement required on the course content any update required which I will do that certainly the next cycle.

Thank you very much and bye.