Structural Health Monitoring (SHM)
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Lecture – 09
Advantages of Structural Health Monitoring- Part 1

Friends, welcome to the 5th lecture in module 1. In the last lecture we discussed about some of the important challenges, which are faced by deploying Structural Health Monitoring scheme or processes in control assessment and monitoring of structures of various applications, like civil engineering structures, mechanical structures, aircraft structures, offshore structures etcetera.

In this method we will discuss about some critical and exclusive advantages of structural health monitoring deployment. In addition to that we will also see what are the latest methods of non-destructive evaluation; which are actually deployed along with SHM to assess the current status of health of structures.

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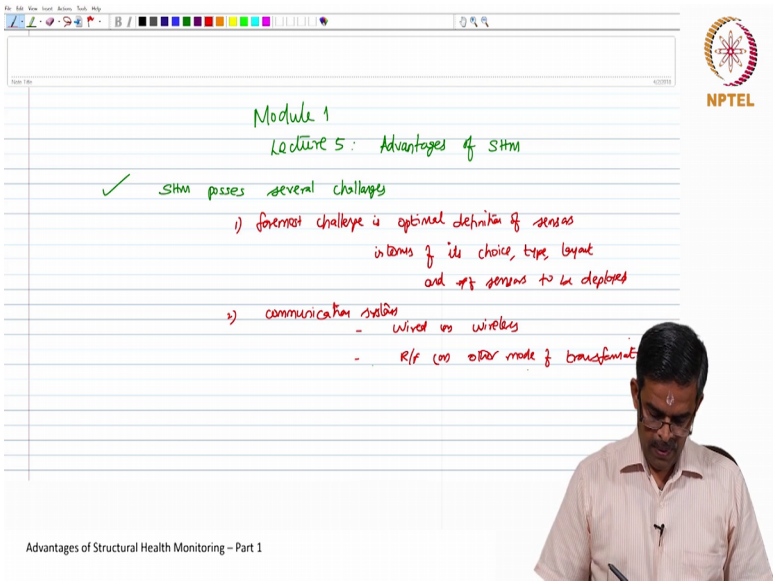

So, having said that structural health monitoring possess several challenges. We know the foremost challenge is optimal definition of senses in terms of it is choice, type, layout and number of sensors to be deployed. The next challenge comes from the communication systems, whether these sensors will be wired or wireless and whether the communication will be through R F or other mode of transformation.

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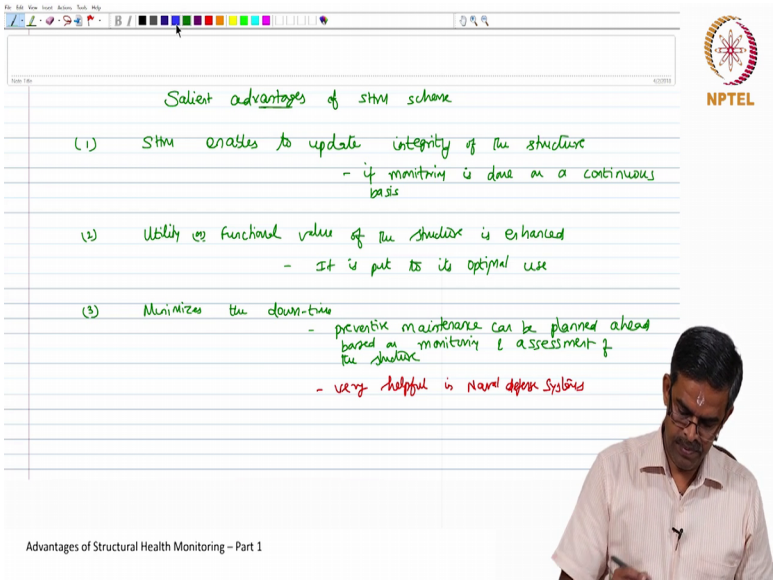

Let us say there are some salient advantages of deploying structural health monitoring scheme. These advantages are common to varieties of structures like civil engineering infrastructure, mechanical systems, offshore structures, naval systems and aircraft structures or aviation structures, nuclear reactors etcetera.

One of the main advantage which is very, very critical which is most welcomed by engineering fraternity is structural health monitoring scheme enables to update integrity of the structure. This is true if monitoring is done on continuous basis; therefore, the utility value of the structure is enhanced. It means, we can say that the structure is put to it is optimal use.

It minimizes the downtime, on the other hand a preventive maintenance can be pre planned based on the monitoring and assessment of the structure. Friends, this is very helpful in naval different systems.

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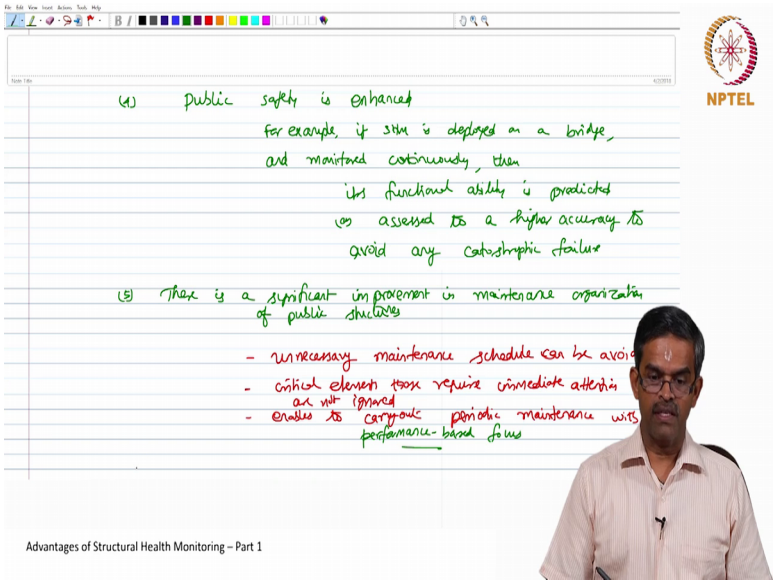

The fourth one could be as we all agree public safety is enhanced. For example, if SHM is deployed on a bridge and monitored continuously, then it is functional ability is predicted or assessed to a higher accuracy to avoid any catastrophic failure. There is a significant improvement in maintenance organization of public structures.

One can avoid unnecessary maintenance, critical elements those require immediate attention are not ignored under SHM deployment. It enables to carry out periodic maintenance with let us say, performance-based focus. Friends, this is a very recent trend which enables lost of cost saving and engineering efficiency in planning or I should say pre planning maintenance in terms of structures of very high strategic importance.

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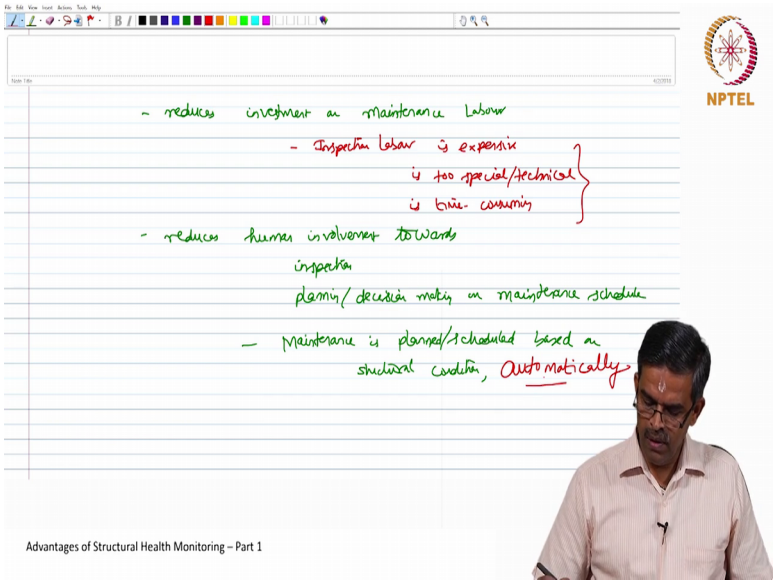

Further it reduces investment on maintenance labour. You know, inspection labour is expensive. It is also too special and technical and it is time consuming. All these three can be avoided if we have a regular maintenance schedule. I should say that SHM reduces human involvement towards inspection, planning and decision making on maintenance schedule.

Maintenance is actually planned, scheduled based on the structural condition I should say automatically.

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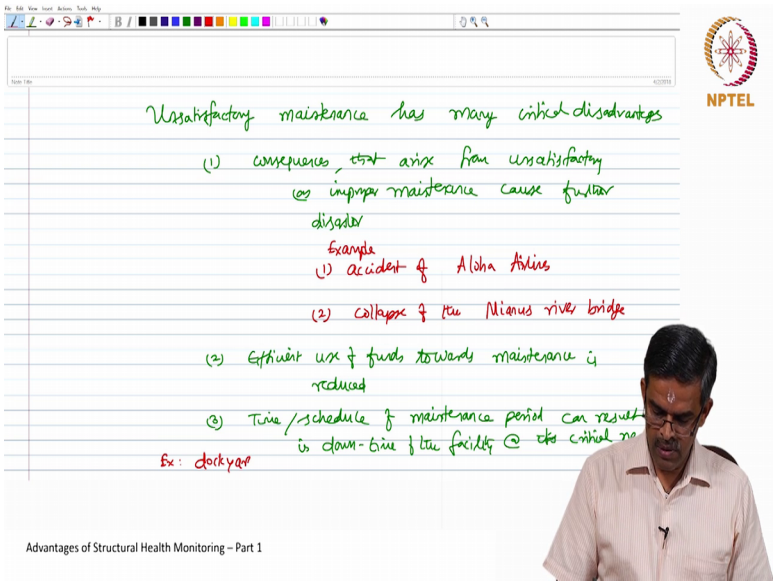

Friends, we have to agree upon one particular point, that unsatisfactory maintenance has many critical disadvantages. The consequences that arise from unsatisfactory or improper maintenance cause further disaster. Example accident of Aloha Airlines is a classical example of unsatisfactory or improper maintenance.

We can also quote collapse of the Mianus river bridge. The second is efficient use of funds towards maintenance is reduced if you do unsatisfactory maintenance. Third, the time and schedule of maintenance can result in downtime of the facility at it is critical need example can be dockyards.

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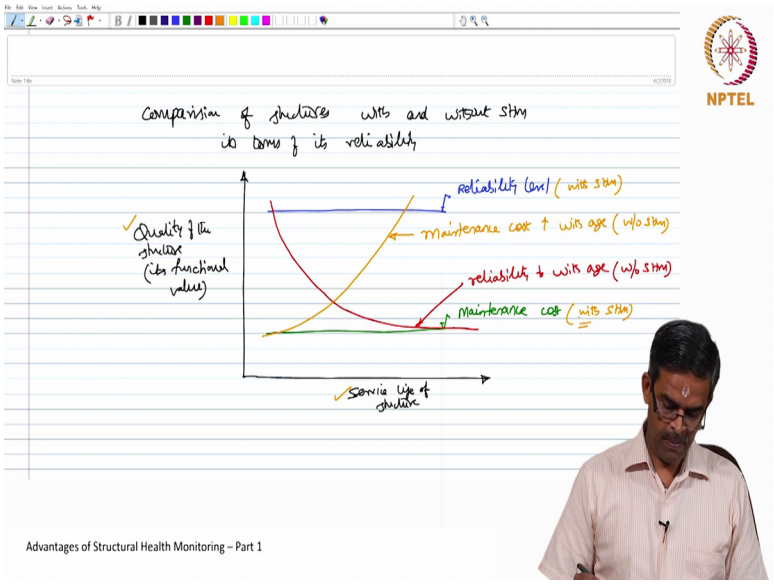

Interestingly let us try to compare structures with and without SHM in terms of it is reliability. This plot shows a comparison of two set of operations where one set of structures are with SHM deployment, another set is without SHM. We will be plotting the service life of the structure in x axis, and quality of the structure in terms of its functional value in the y axis.

Let us say this is my level of reliability requirement. And this is my maintenance cost, if I have a system which is without SHM, reliability initially will be very high and reliability decreases with decrease in quality as the service structure increases.

So, this indicates there is a reduction reliability with age, which is true with structures without SHM. On the other hand, if I have a structural system with SHM, reliability will

keep on increasing with the age of the structure. But in the maintenance cost will also be increasing with the age when the structure is without SHM. On the other hand, when you have a system with SHM you will see that the system will have more or less, a constant maintenance cost and more or less a standard reliability level.

So, deploying SHM in terms of the quality of the structural system, and enhancement in service life can be achieved with more or less a standard maintenance cost or lower maintenance cost provided you spend deployment of SHM in proper methods.

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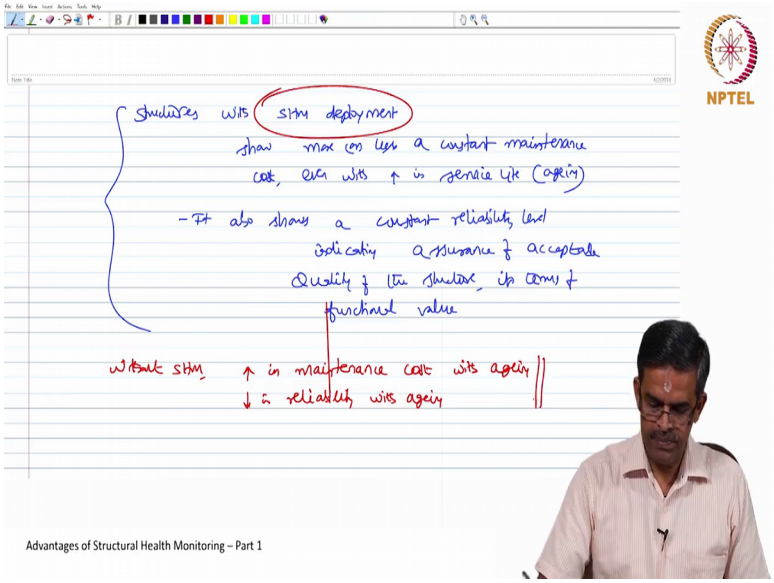

So, one can say structures with structural health monitoring deployment show more or less a constant maintenance cost, even with increase in the service life of the structure; that is ageing.

It also shows a constant reliability level indicating assurance of acceptable quality of the structure in terms of it is functional value, both these are possible if you have a structural system with SHM deployment. Of course, without SHM there is increase in maintenance cost with ageing, there is decrease in reliability with ageing.