**Structural Health Monitoring (SHM)**
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**Lecture – 08**
**Challenges in Structural Health Monitoring- Part 2**

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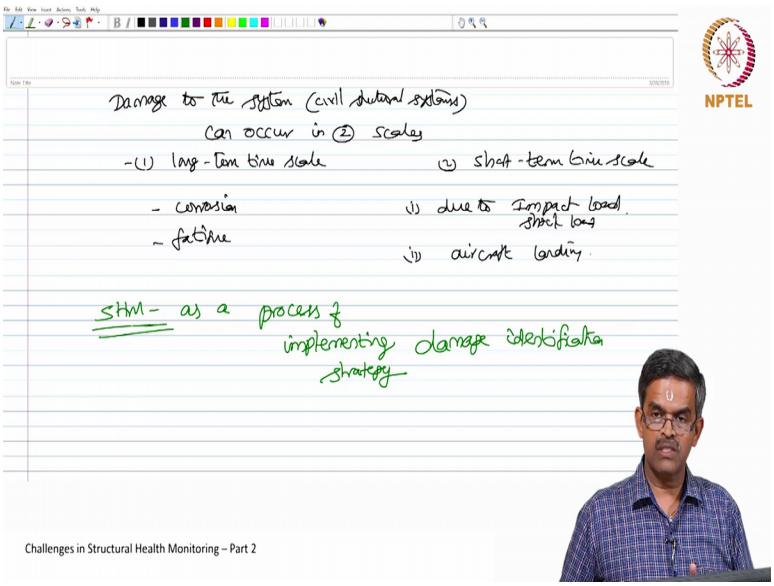


Now, friends damage to a system essentially civil structural systems, can occur in 2 scales. Both are time scales, one is long term time scale; other is short term time scale. The long-term timescale it can be corrosion, it can be fatigue. The short-term time scale can be caused due to impact loads, shock loads etcetera.

Essentially, it can be also during let us say for example, aircraft, landing, in aviation industries. Therefore, let us redefine SHM as a process of implementing damage identification strategy; that is, a redefinition of SHM under damage perspective.

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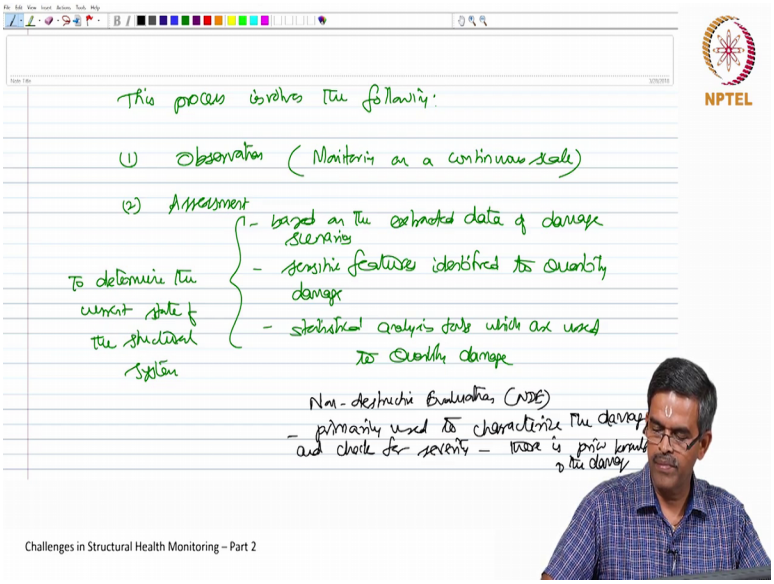


This process involves the following; one, observation which is otherwise called as monitoring on a continuous scale. Second is assessment, which is based on the extracted data of damage scenarios. It depends upon the sensitive features identified to quantify damage.

It also depends upon the statistical analysis tools, which are used to quantify damage. All of them put together will determine the current state of the system. Let us say structural system. Ok, in this process non-destructive evaluation plays a very important role. Is actually primarily used to characterize the damage, and check for severity when there is prior knowledge of the damage.

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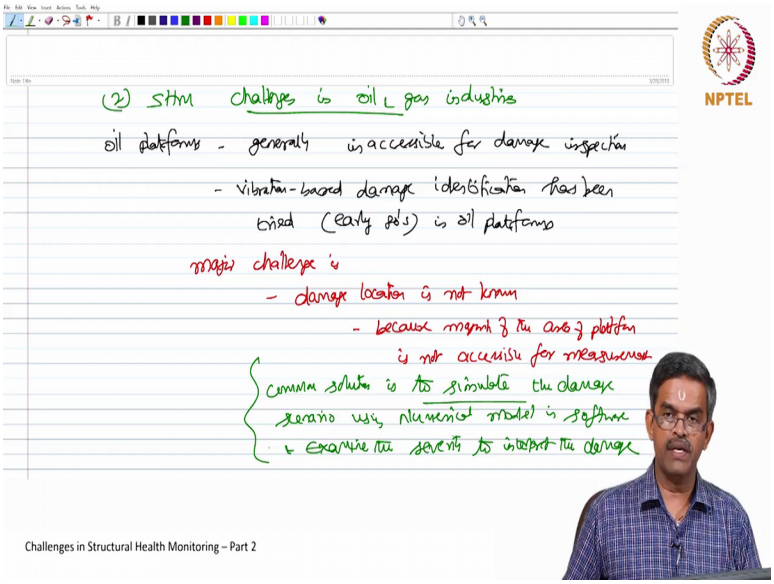


Let us take another example of SHM challenges in oil and gas industries. We all agree that, oil platforms are generally inaccessible for damage inspection. So, vibration-based techniques for damage identification has been tried in early 80's in oil industries. But there are some specific issues which makes this application has a very highly challenging technique.

The major challenge is the damage location is not known. Because, majority of the area of platform is inaccessible for measurement; then what is the common solution? The most common solution is to simulate, the damage scenario using numerical model in a software and examine the severity to interpret the damage. That is a common practice which is being done in oil platforms.

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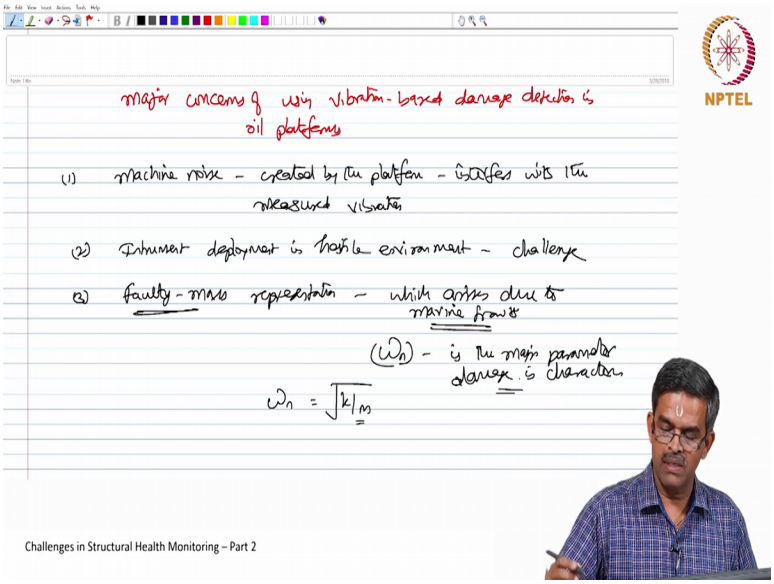


There are major concerns of using vibration based damage deduction in oil platforms let us see what are they

The machine noise created by the platform interfers with the measured vibration; instrument deployment in hostile environment is also a challenge. The third one is about a faulty mass representation, this arise due to marine growth. You know in vibration-based damage detection, natural frequency of the system is the major parameter based on which damage is characterized.

And, we all do agree this is a function of stiffness of the system and mass of the system. When there is a faulty mass which arise on the platform due to marine growth, it does not exactly give you the damage characterization as simple as it applies to other structures.

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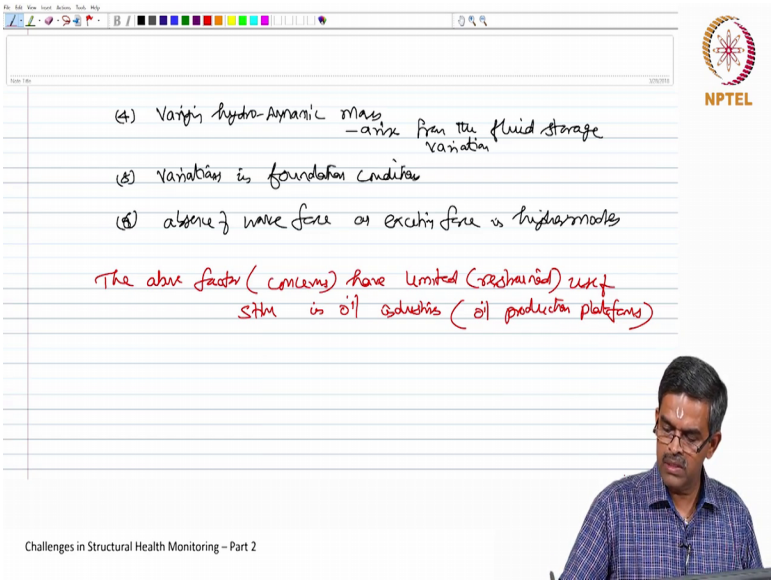


Fourth could be, the varying hydrodynamic mass, which arise from the fluid storage variation. The next challenge could be variations that arise in the foundation conditions in due course of time. Next could be absence of wave force as exciting force in higher modes.

Therefore, as a result the above factors or I should say concerns have limited. I should say restraint use of structural health monitoring in oil industries; especially on oil production platforms. Of course, they are very well and continuously used in ships.

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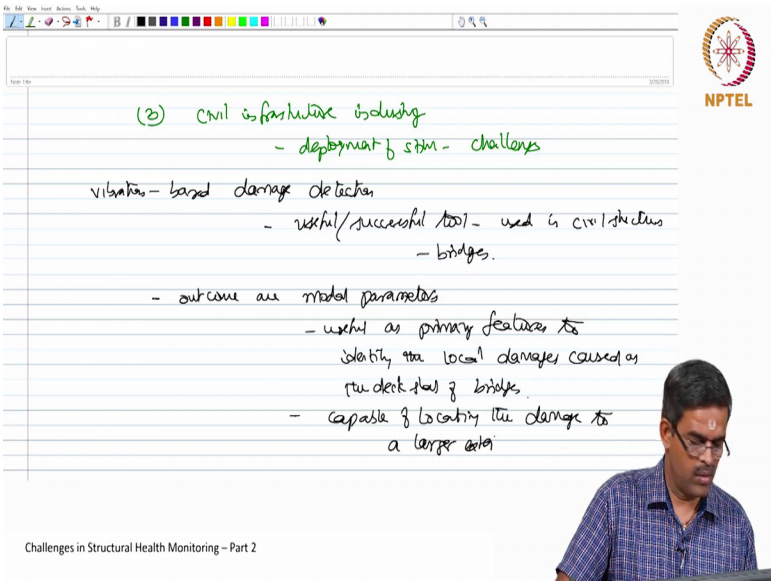

Let us take another example of civil infrastructure industry and look at the challenges of deploying SHM, and let us see what are the challenges. Vibration based damage detection is a very useful and successful tool, which is used in civil structures, especially bridges.

The outcome of the study are generally model parameters, which are very useful as primary features to identify the local damages caused on the deck slab of bridges. They are capable of locating the damage to a larger extent.

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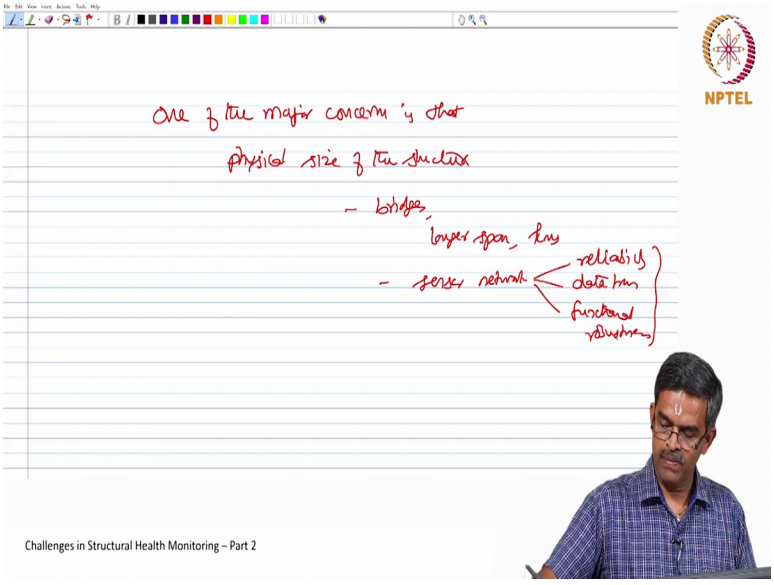


One of the major concern in a plane SHM to civil infrastructure is that, physical size of the structure. For example, when you talk of bridges whose desk lab is very, very long span and spread 4 kilometres, it is very difficult to have a sensor network in terms of it is reliability, data transmission and it is functional robustness. That can be one of the difficult areas to diagnose in terms of application of SHM on civil infrastructures.

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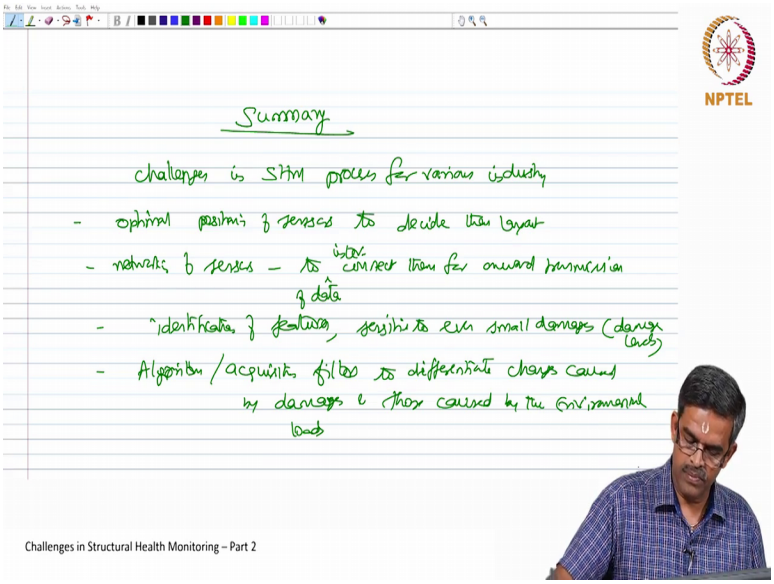


Let us quickly see the summary of this lecture now. We are talking about challenges in deploying structural health monitoring process for various industries, we took example of aviation industry, oil and gas production systems, mechanical systems and civil infrastructure.

Some of the major challenges could be optimal positioning of sensors to decide their layout, networking of sensors to connect them or I should say to interconnect them for onward transmission of data, identification of features, which are sensitive to even small damages or I should say small damage levels.

Algorithms and acquisition filters to differentiate changes caused by the damages, and those caused by the environmental loads. Finally, development of statistical methods to discriminate features of a damaged and undamaged systems.

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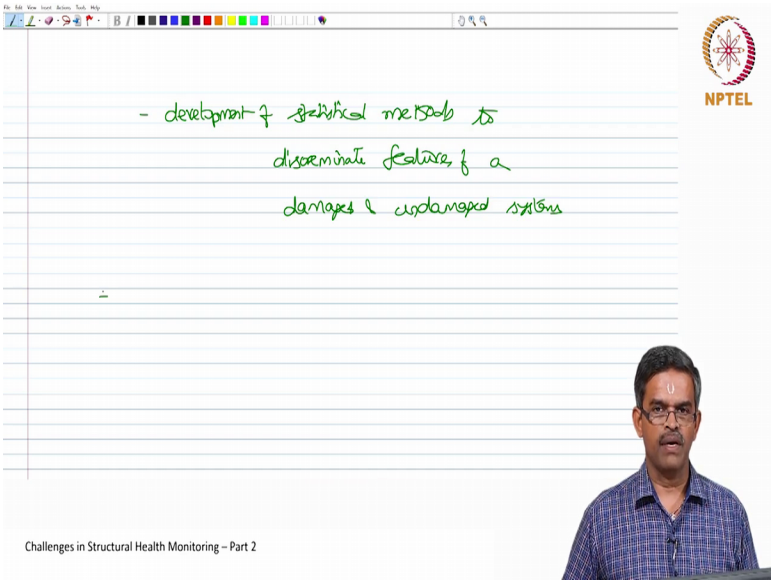


So, friends, in this lecture we learnt about the tools used for health monitoring, some of the critical challenges, some of the field examples in lab scale as well as real time scale; where SHM has been successfully deployed and benefits have been derived using SHM in those particular applications.

Thank you very much and bye.