Structural Health Monitoring (SHM)
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Lecture - 34
Vibration based health monitoring scheme - Part 2

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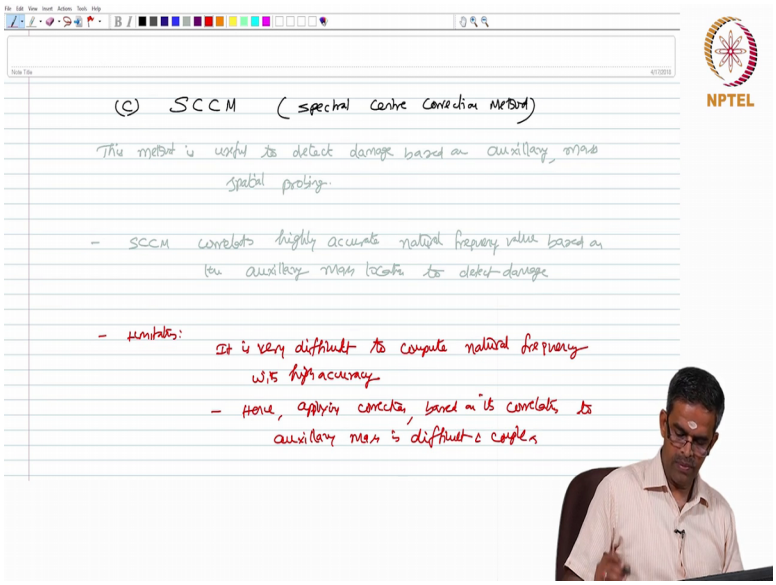

The next method in frequency based damage detection is SCCM, which is Spectral Center Correction Method. This method is useful, to detect damage based on auxiliary, mass spatial probing. Actually SCCM correlates highly accurate natural frequency value based on the auxiliary mass location to detect damage.

One important limitation of this method is it is very difficult to compute natural frequency with high accuracy. Therefore, applying correction based on it is correlation to auxiliary mass is difficult and complex.

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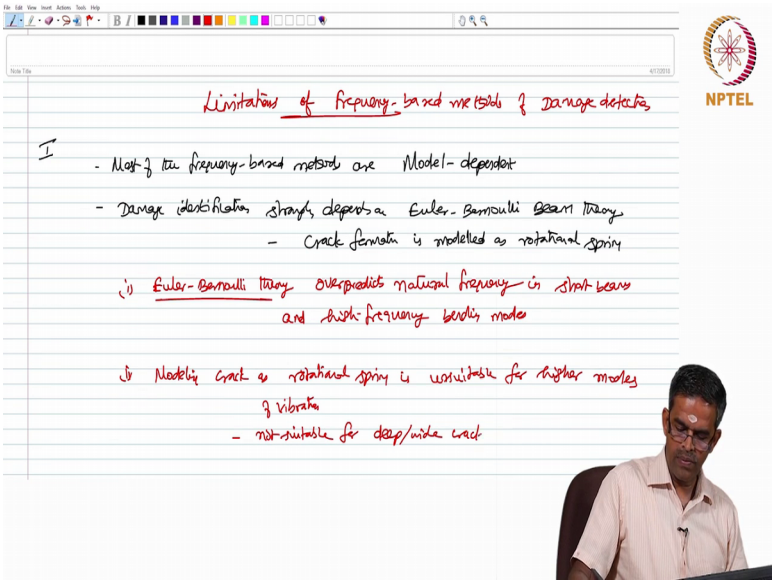

So, now let us see; what are the limitations in general of frequency based methods of damage detection. First most of the frequency based methods we have highlighted 3 of them or model dependent, damage identification strongly depends on Euler Bernoulli Beam Theory. In this beam theory crack formation is modeled as rotational spring.

Now, there are some limitations of this specific identification, Euler Bernoulli Beam Theory over predicts natural frequency in short beams and also high frequency bending modes, that is the first one. The second one modeling crack has rotational spring is unsuitable for higher modes of vibration; it is also not suitable for deep wide cracks.

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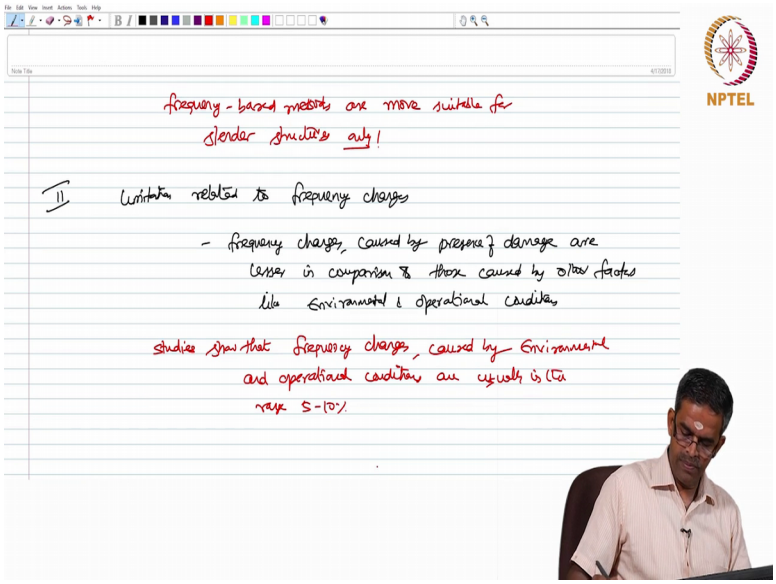

Therefore frequency based methods are more suitable for slender structures, I should say only with an emphasis.

Now the second issue yes limitation related to frequency changes, because this method essentially has a basic objective the damaged or deducted based upon change in frequency, there is a limitation related to that itself frequency changes caused by presence of damage, which the ideology of this method or lesser in comparison to those caused by other factors. Other factors can also cause change in frequency like, the environmental and operational conditions.

Let us say for example, different studies the reference are given in the end of the NPTEL website, you can see that studies show that frequency changes, caused by environmental and operational conditions or usually in the range 5 to 10 percent.

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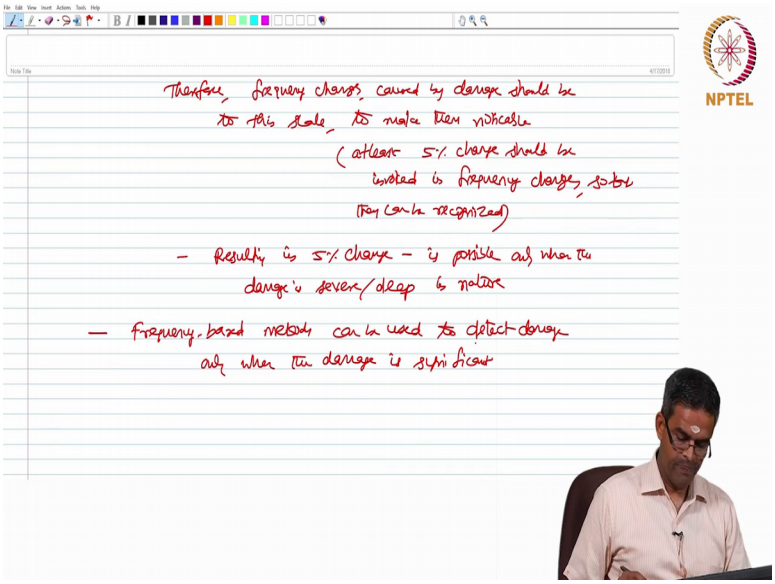

Therefore, frequency changes caused by damage should be to this scale to make them noticeable. It means at least 5 percent change should be invoked in frequency changes so, that they can be recognized.

Now, the most difficult task is resulting in 5 percent change is possible only when the damage is severe or deep in nature. So, we have a conclusion here saying that, frequency based methods can be used to detect damage only when the damage significant.

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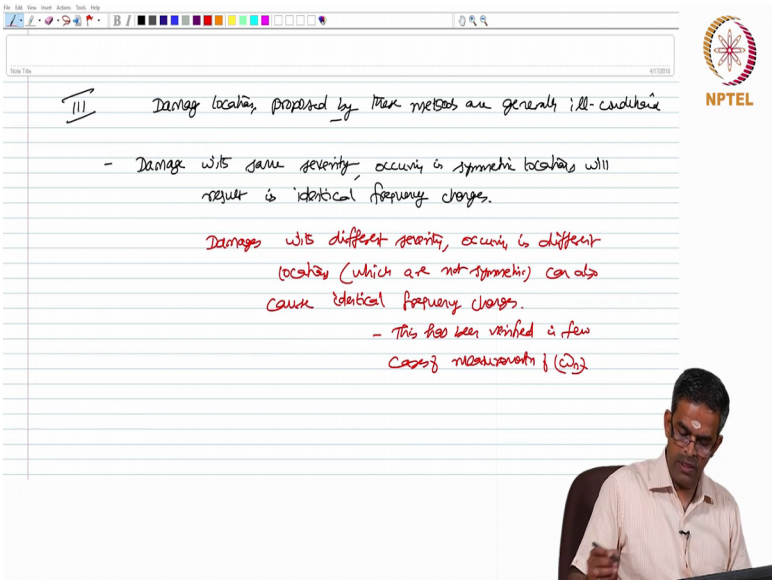

The third issue, which we have here damage location proposed by these methods or generally ill condition what does it mean?

It says that damage with same severity occurring in symmetric locations will result in identical frequency changes, you may think it is an advantage, but please note damages with different severity, occurring in different locations which are asymmetric, can also cause identical frequency changes, this has been verified in few cases of measurements of natural frequency.

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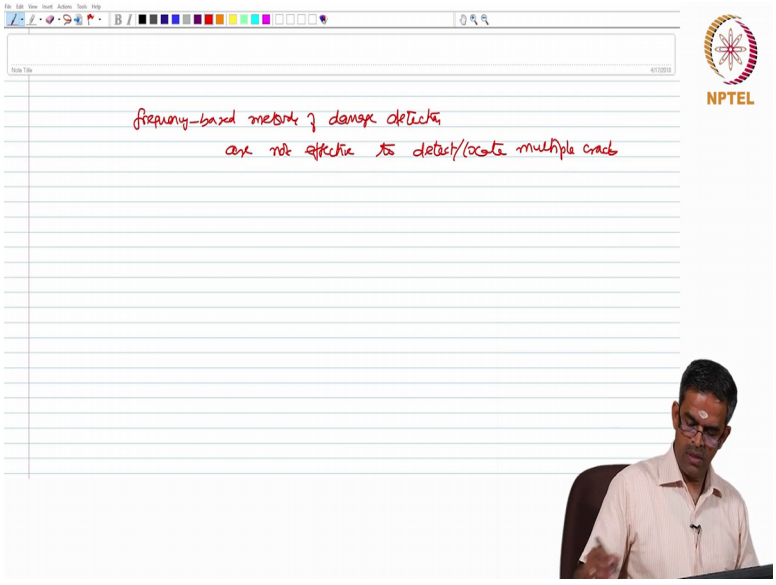

If this is true then we put a condition here saying that frequency based methods of damage deduction are not effective to detect or locate multiple cracks.

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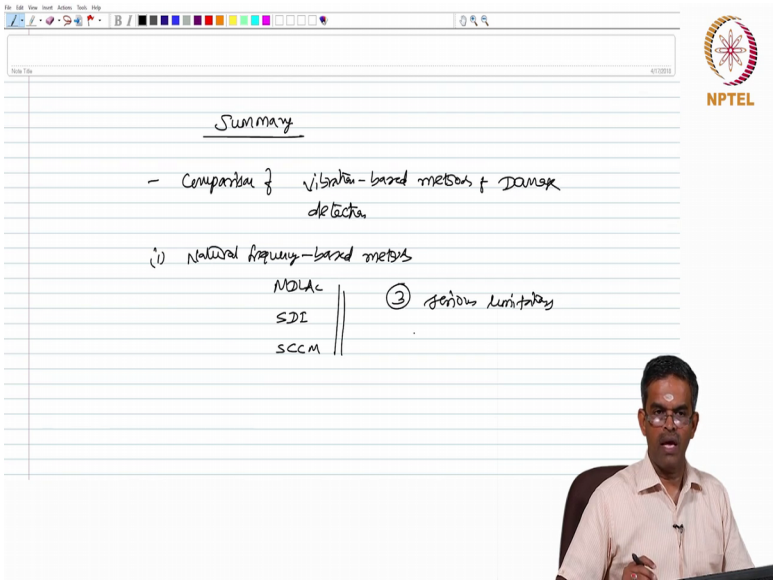

So, friends let us look at the summary in this lecture, we are talking about comparison of vibration based methods of damage detection to start with we looked closely the natural frequency based methods, we discussed MD LAC method, we discussed SDI method, we also discussed SCCM method, and compared that there are 3 serious limitations, if they are deployed to find out damage detection.

In the coming lectures, we will further discuss about and compare other methods and then we will have an overall view of all the vibration based techniques to really know how powerful? How useful are they to employ in structural health monitoring and how they can be useful and powerful in damage detection and localization.

Thank you very much and bye.