Lecture – 82
Part-2: Structural Health Monitoring (SHM) of lab scale model of TLP-IV

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Your typical STFT plot for surge response will be now shown. This is a 3d graph, where both the surge response under normal and postulated failure are shown.

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This is the normal case, and this is the postulated failure case 2. You have wide range of frequencies, variations, occurring throughout the time history are successfully captured this is the frequency plot, we look at the frequency plot the plot may look like this, ok. But when you look at the time plots variation you can see there are lot of peaks which are appearing along the time at the same frequency ok, the same frequency lot variations happening along the time.

That is true in both the cases even in postulated failure case as well as in the normal case you can see. This variation this variation is effectively captured when you do the short term Fourier transform which is acquired for the data analysis to find out the time localization of the damage.

So, this data is useful in diagnosing the condition of the platform far further assessment, ok.

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In terms of heave is also shown you can see here multiple frequencies, and this is for the pitch response multiple frequencies and at the same frequency multiple variations in time ok, all are captured very nicely with respective amplitude being shown. The values may be small, but the variation is sensitized on the time localization which is otherwise not interpolated and interpreted correctly in the Fourier transform, failure case 4.

So, friends once this is estimated the next task is to inform the client about the damage because the SHM system which we have proposed is able to capture the damage, ok.

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By doing interesting and intelligent post processing one can do the damage identification and one can do the damage localization and time as well. This is done with FFT, this is done with STFT as we just now saw. Now, the design is leading towards alert monitoring briefly we call as alert monitoring system AMS.

The data acquired by the sensors is transmitted to the base station. This is now stored in my SQL database as we discussed in the last lecture as well. Now, the acquired data is processed for viewing it as a report because I would like to see in a report form, or the actual response will be compared with the preset threshold value, ok. But in this case the threshold value refers to the maximum amplitude of vibration in the undamaged scenario that is what we have taken.

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This will be compared in the real time monitoring layout of sensor nodes will be integrated with a database. So, one will also know exactly at what location the damages occur, physical location where damages occur from the report, ok. For example, let us say sensor node 1 corresponds to let us say leg 1. So, one can say that leg 1 is damaged. So, from the report one will know the physical location of the damage, quantification of the damage and now we are talking about how to alert the user using alert monitoring system.

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The central server will initiate and SMS to the registered mobile number 1hich is RMN on exceedance of the threshold value. So, very interestingly with the SMS-API, SMS is triggered from the website for 2 factor authorization.

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Typically you can see here how the SMS activation happens. This has been a real time measurement made during the conduct of the experiment. So, there is a local host which has been configured for this experiment. It has been generating a serial id automatically. This is a data on different degrees of freedom you can say displacement along x y z role and pitch.

For example, let us say the pitch value which is indicating in crayon colour as exceeded the threshold value. The threshold value may be shown for example, in the orange line. So, the tabulated value is also available the threshold value has been indicated, and when the response exceeds the threshold value, when the response exceeds the threshold value there should be a system which should go integrated the alert of this, ok. That will again generate an SMS to the user and an email to the user where the SMS indicates an message saying that leg 1 has failed for example, ok. Whereas, email says a complete report as you see in the screen here.

So, one will know what is the level of exceedance, when it has occurred, what is the local location of the damage, and what is the quantification. So, this structural health monitoring system in a case 2 which is deploying wireless sensor networking has

successfully executed the alert monitoring systems and that becomes my end of this problem saying that I can generate an alert message on exceedance.

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So, friends in this example of application, we have clearly seen the complete design of structural health monitoring on a lab scale for both wired and wireless sensor. We have discussed the specification of the sensors, processor unit, transmission protocol, and we have also seen in detail about the data analysis to check the damaged identification and the time localization of the damage for post processing.

Once it is done and the value is compared with the threshold number which is preset in the system in an undamaged state, then the alert monitoring systems raises an SMS alarm and an email alert to the user indicating the location of damage, quantification of damage etcetera which shows the complete success of the implemented SHM on the lab scale.

We have few more lectures where we discuss about the alert monitoring system on the bale SRP will show that. Then will also talk about what is the future scope of structural health monitoring in the present scenario.

Thank you very much and bye.