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

Lecture – 42 Part – 1: Non-Destructive evaluation – II

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	Module 2	NPI
	Lecture 4: Non-Destruction Evaluation -I	
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Friends, we will continue to discuss the last lecture in module 2, which is lecture 14. In this we will discuss the extension of Non-Destructive Evaluation as a second series lecture which is a continuation of the last lecture. Based on the incidence of the transducer with respect to the surface waves may be created it may be P waves, S waves or their combination. This waves detect anomalies around the sound path they travel.

In pulse echo method, defects are detected in the form of echos. Alternatively in pitch catch method flaws are detected by wave dispersion caused due to damage.

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	Pitch-Catch metsud		N
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Pitch catch method is suitable for embedded non-destructive evaluation. This method can be used to detect the structural changes that take place between the transducers: one transducer will be placed as a receiver, another transducer will be working as a transmitter. So, between the two transducers one is a receiver other is a transmitter the changes between take place between these two will be able to detect the flaws or the damages on the structure which is being examined.

Pitch catch method can detect changes that are created by guided wave amplitude, phase difference between them, and they are dispersion.

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This method has the following applications: corrosion detection in metallic structures, damage detection in composite materials, detection of de bonding in adhesive joints, detection of de lamination in layout composites. In the embedded method of nondestructive evaluation transducers are permanently inserted either between the layers of the composites or on the structure; they are actually attached to the structure permanently.

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Advantages of crack det	there is metallic structiones:
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Now, let us see what are the advantages of crack detection in metallic structures. Friends, cracks in metallic structures generally form and propagate perpendicular to the surface. Generally, it can cover the whole thickness. If it covers the whole thickness in such cases the track is called through thickness crack. The consequence of this of such crack is that it can clear the metallic structure.

In the conventional NDE, cracks in metallic structures are generally detected with ultrasonic or eddy current probes.

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- one of the limitations of they mobert is they can detect cracks/flams any @ particular porns - If are need to Granie crack presence of the whole surface are shall have to manually scan over the complete surface to deket crade - This is very tedious exercise - possibility ? overaghting a few crack locators This produm can be concored by pitch-catch metory

One of the limitations of this they can detect cracks or flaws only at particular points: if one need to examine crack presence of the whole surface one should have to manually scan over the complete surface to detect cracks. This is a very tedious exercise, and this has a possibility of over sighting or few crack locations. This can be avoided this problem can be corrected by pitch catch method.

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Thus The	while member/material is analyzed for
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crack	cru chapte in amplitude
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complete surface	

In pitch catch method guided waves are transmitted from one location and received in another location. Thus, the whole member or material is analyzed for: one the guided wave shape and its amplitude, the phase law created betweens the end signals, and change in amplitude. This will help us to detect presence of cracks without manually scanning the complete surface.

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pilon-catch metsol can deter pressure & cracts and also liver extension, wittoout scanning (nonwelly) the whole surface.	NF
- productility of Gack detection by pitch Catch method is higher than draw method. This is give by The following relationstry.	
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What M + f crack events recorded by NDE metrod	
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pitch- Catch webson is also effective is debuily fabiour Creek propagation	
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So, this can be seen as one of the important advantage of pitch catch method of NDE when it is used for crack detection in metallic structures. Pitch catch method can detect

presence of crack and also their extension without scanning the whole surface manually. Now there are researches who ascertain that probability of crack detection by pitch catch method is much higher than other methods. This is given by the following relationship: probability of crack detection by pitch catch method is equals to sum of cracks recorded by pitch catch method divided by M minus N plus 1. Where, M is a number of crack events recorded by non-destructive evaluation method and N is number of serial events.

It is very important to note that pitch catch method is also effective in detecting fatigue crack propagation.

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	Victor Giugiutiu, Adrain Cuc. 2005.	
	Embradical Nou-destructive Evaluation for structured Hells monitoring damage detection and failbure prevention, shock i vite digest, 37(2): 83-105	
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Additional reading on this subject more can be seen from the following reference: shock and vibration digest in the year 2005.