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Analysis of Cantilever Beam with PZT Patchs in Abaqus

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Abstract - Recent advantages develops the proper method to detect crack by using piezo electric sensors. It is necessary to check and find out best suitable location to detect the crack by using the software before the actual practice .There are various software available to analysis the structure with sensors and give best suitable location of sensors , The paper aims at finding out best location by using abaqus software. The results obtained are in the wave form on a concrete beam which locates the crack in the beam

***Key Words*: Sensors, Non destructive, abaqus, piezo electric, cantilever beam, etc**.

1. INTRODUCTION

When stress is applied to Piezoelectric material will give rise to potential difference or strain is introduced to the material This special characteristic is due to the motion of the dipoles which result in the change of the dipole moment inside the material. However, this characteristic can totally be eliminated if excessive mechanical stress, electrical stress or very high temperature is applied to the materials, which result in the de-poled of the material to occur the electro-mechanical characteristics of the piezoelectric material make it suitable to be used as actuators or sensors. Research is actively been carried out to show that it can be used as a device for defect detection in structural component. one piezoelectric material was used as the source to produce ultrasonic signal and the other piezoelectric material was used as a source to receive the signal. In this case any change in the signal due to the defect and this study showed that the presence of a crack would reduce the amplitude of the received signal. Abaqus software analysis give proper solution and wave form with respect to different sensors parameter

1.1 Modelling data

In this model square cross section of 0.35m X0.35m is considered. The dimension of PZT patch of 10X10X0.3mm considered.The cantilever beam of length 4m is considered and grade of concrete of M20 grade are prepared in the laboratory and tested by the software.

1.2 Modelling

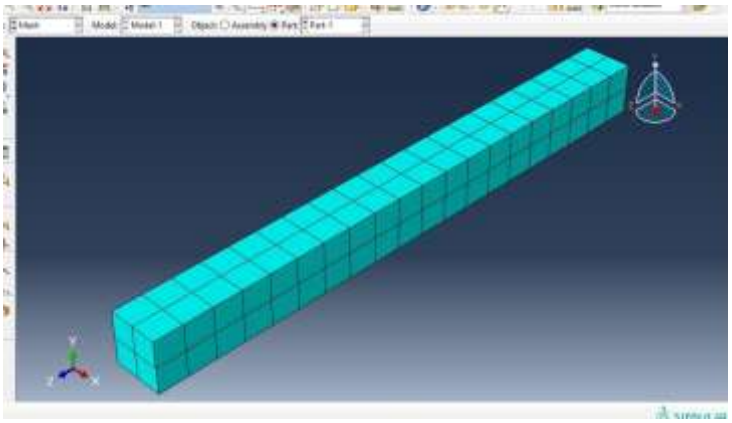

Fig-1 Beam with standard meshing

In the above cantilever beam modelling the beam is analyzed with standard meshing and PZT patches placement is studied. The basic idea of modelling is that to study of actual behavior of structure before actual placement of sensors.

The PZT patches. The analysis matrix of PZT sensor is selected as strain matrix and engineering constants are selected based on requirement.

The general analysis procedure consists of the following stages of elastic analysis:

1) To determine best location of PZT patches to detect accurate damage.
2) TO visualize the damage pattern with abaqus analysis.

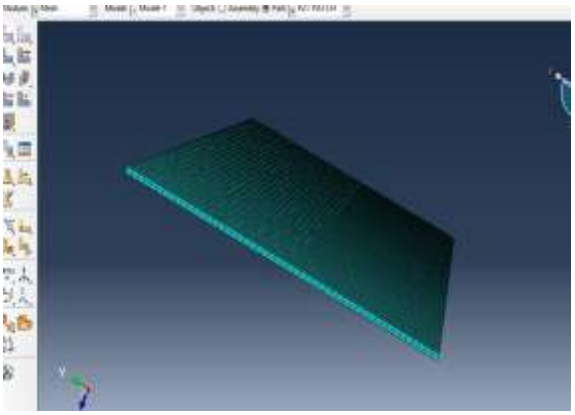

Fig-2 PZT patches with standard meshing

1.3 Properties of sensors

Following are the properties of piezo electric sensors

Which is used for the analysis

Table -1: PZT sensor properties

properties	value
E1(Elastic property)	60.61e9
E2(Elastic property)	60.61e9
E3 (Elastic property)	48.31e9
μ12 (poissons ratio)	0.289
μ13 (poissons ratio)	0.512
μ23 (poissons ratio)	0.512
G12 (Elastic properties)	23.5e9
G13 (Elastic properties)	23e9
G23 (Elastic properties)	23e9

The properties of sensors selected depending upon the accuracy and various parameter requirement.

2. Result

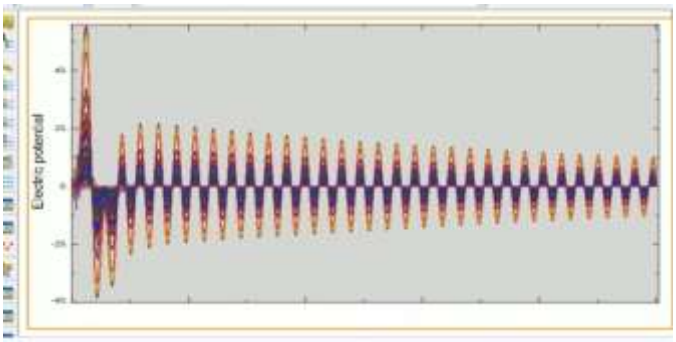

Fig-3 Electrical potential variation with repect to location of sensors.

Result obtained are in the wave form of electric potential at different location of beam length when point load is applied at the free end. The wave form gives the best location of PZT patch at fixed support.

3. CONCLUSIONS

1) While cracking the amplitude of output wave of PZT patches decreases.
2) PZT patches placement at suitable spacing depending upon the length and location of load is found more suitable to detect damage in flexure member.
3)For the cantilever Beam the location of PZT patch near fixed support is found more suitable to detect the crack.

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