ULTRASONIC RESPONSE FROM BURIED DEFECT BY CRACK TIP DIFFRACTION TECHNIQUE

by

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ABSTRACT

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An ultrasonic crack tip diffraction technique is one of the technique used in detection of buried defect in welded steel. To obtain the desired condition with regarded to welded steel maintenance, a research project has been initiated. The objective of this project is to develop a fast and reliable ultrasonic crack tip diffraction technique for detection size and depth of buried defect in steel. Time of flight diffraction method and crack tip diffraction technique are both using time of flight measurement of the diffracted signal from the crack tip, are employed. For this experiment, 56.77mm of probe distance, 7.20mm of probe diameter were used. Calibration block, which have notch at 50%of through depth for correct calibration was used. A relationship between measured value of steel can be observed by using the amplitude shown on the screen. It shown, the actual value and measured value depth of defect in steel does not have any significant discrepancy.

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CHAPTER 1

INTRODUCTION

Ultrasonic inspection is non-destructive method in which use high frequency sound waves are introduced into the material being inspected. The most useful and accurate ultrasonic technique suitable for this purpose was the crack tip diffraction technique. This technique is used for sizing shallow cracks ranging from approximately 5-35% through wall. In this technique the arrival time of the signal from the tip of the crack is used to determine crack depth. To simplify this process the instrument is calibrated so that each screen division corresponds to a particular flaw depth. Typically each of the first five screen divisions is chosen to represent 20% of the material thickness. So, a 20% through wall crack will produce a signal at the 4th screen division, a 40% through wall crack will produce a signal at the 3rd screen division etc. Also noted during this technique is the separation of the tip signal from the corner reflection. The information obtained from this separation allows the operator to make a final and accurate determination of crack depth. In USA, this method was first applied for crack detection and sizing (depth, length) in austenitic pipe welds. The crack tip diffraction technique using the principle, when an ultrasonic wave interacts with a planar flaws it results in the production of diffracted wave from the tips of the flaw in addition to the normal reflected wave. This diffracted energy is emitted over a wide angular range and is assumed to originate at the extremities of the flaw. The diffracted energy is well suited for flaw detection as signals may be recorded from the range of flaws of different orientations using a two probe (transmitter-receiver arrangement). The concept of time of flight approach to the detection, location and