UNIVERSITI TEKNOLOGI MARA

INVESTIGATION AND CHARACTERISATION OF SURFACE CRACKS IN METAL COMPONENTS USING TIME OF FLIGHT DIFFRACTION (TOFD) TECHNIQUE IN COMPARISON TO ALTERNATING CURRENT FIELD MEASUREMENT (ACFM) TECHNIQUE

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of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted by other any other academic institution or non-institution for any degree or qualification.

I, hereby acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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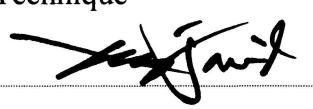
Signature of Student	:	
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ABSTRACT

This research describes an investigation and characterisation of Time of Flight Diffraction (TOFD) technique when it interacts with surface defects in metal component. Four steel plates of thickness 19 mm were used in this study. Electrical Discharge Machine (EDM) was used to fabricate the artificial surface cracks with various depths, angles and orientations. In case of TOFD technique, two TOFD probes of 5 MHz at angle 60° and 70° were used in this study with the different Probe Center Spacing (PCS). The latter was determined by using ESBeamTool software. Difficulty was experienced in using TOFD at an angle of 60° for detecting and sizing surface defects whereas successful results were achieved at angle 70°. The characteristic of defect signal was analysed based on surface defect severity. TOFD works well for most cases but surface crack that shallower cracks of 3.0 mm with inclination angle 40° (Notch 8) and 50° (Notch 9) could not be detected. This is due to the fact that crack signal were superimposed with the lateral wave and cannot be resolved separately. This is compliant with the proven practical limitation of the TOFD technique in detecting and sizing of shallower defects. The ACFM Standard Weld probe (256/5 kHz, TSC Inspection) was applied to the samples. The characteristic signals generated by the surface cracks obtained from B*x*, B*z* and 'butterfly plot' displays were evaluated using ASISTant software. In case comparison between ACFM and TOFD techniques, the study also revealed that small mean errors and standard deviation of depth and length using the ACFM technique makes more accurate than TOFD technique. The outcomes of these studies can be useful for planning an inspection of simple geometry component such as plate and pipe.

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