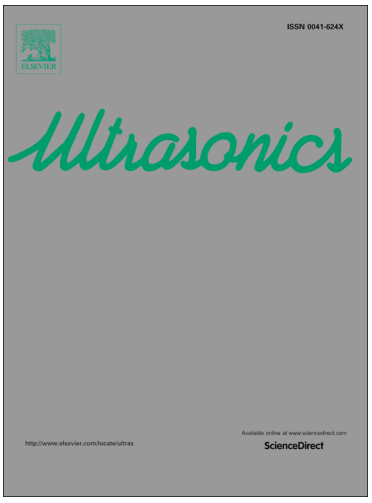

Sizing of flaws using ultrasonic bulk wave testing: a review

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Sizing of flaws using ultrasonic bulk wave testing: a review

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Abstract

Ultrasonic testing is a non-destructive method that can be used to detect, locate and size flaws. The purpose of this paper is to review techniques that utilise ultrasonic bulk waves to size flaws. Flaws that are embedded within a component (i.e. remote from any surface) as well as flaws growing from inaccessible surfaces are considered. The different available techniques are grouped into the following categories: amplitude, temporal, imaging and inversion. The principles, applications and limitations of the different techniques are covered, as well as approaches to assessing the performance of the techniques. Finally, remaining gaps and challenges in sizing flaws, particularly in an industrial setting, are discussed.

Keywords: sizing, ultrasonics, time of flight (TOFT/TOFD), array, ultrasonic imaging

1 Introduction

1.1 Motivation for flaw measurement

In the past few decades, there has been a shift from non-destructive testing to *quantitative* non-destructive evaluation (NDE) [1]. This is because flaws are no longer accepted or rejected based on 'workmanship' criteria, i.e. what the inspection system can detect, but based on 'Fitness-for-Service' criteria or Engineering Critical Assessment [2]. This has been driven by cost reduction in life management of structures, but quantitative NDE can also provide economic benefits during manufacture by controlling processes better [1].

Engineering Critical Assessment (ECA), also known as Defect Assessment, is "the analysis of a defect in a component to establish whether the defect will cause failure of the