



***Parallel 3D Acoustic and Elastic Wave Simulation Methods with
Applications in Nondestructive Evaluation***

KEVIN RUDD

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Advisor: Mark Hinders, Professor of Applied Science

Abstract

In this dissertation, we present two parallelized 3D simulation techniques for three-dimensional acoustic and elastic wave propagation based on the finite integration technique. We demonstrate their usefulness in solving real-world problems with examples in the three very different areas of nondestructive evaluation, medical imaging, and security screening. More precisely, these include concealed weapons detection, periodontal ultrasonography, and guided wave inspection of complex piping systems. We have employed these simulation methods to study complex wave phenomena and to develop and test a variety of signal processing and hardware configurations. Simulation results are compared to experimental measurements to confirm the accuracy of the parallel simulation methods.