

Investigation of Ultrasound Transducer Response

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Introduction

Motivation

Investigation of Ultrasound Transducer Response

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Joyce[†], Alison
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and Kristin M.
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Introduction

Materials and Methods

Analysis

Thesis Outline

Timeline

- Ultrasound transducers are used by geophysicists to characterize heterogeneous rocks, and by medical professionals for diagnostics and therapeutics.
- Existing research suggests that the waves induced in a material do not necessarily have the same properties as the input waveforms [1].
- Transducer outputs vary when transducers are coupled with different materials. Each coupled system is unique and requires study.

Introduction

Objectives

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Goals:

- (a) Quality Control - Understand transducer outputs for different coupled systems.**
- (b) Develop a protocol to inform researchers of necessary parameter adjustments when working with ultrasound transducers.**

Materials and Methods

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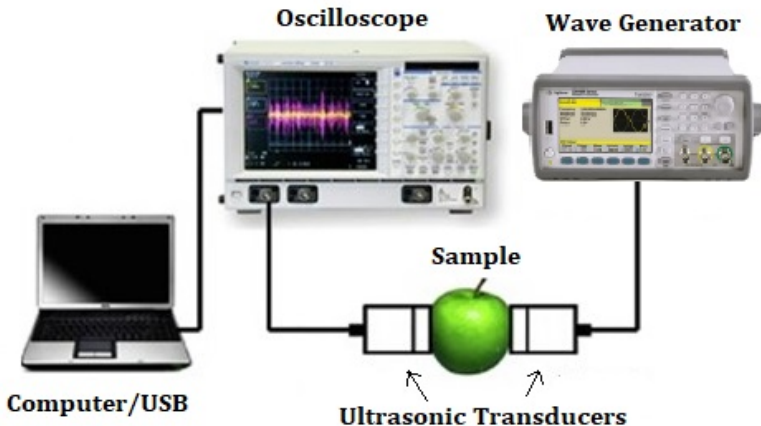
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Analysis

Raw Data

Investigation of
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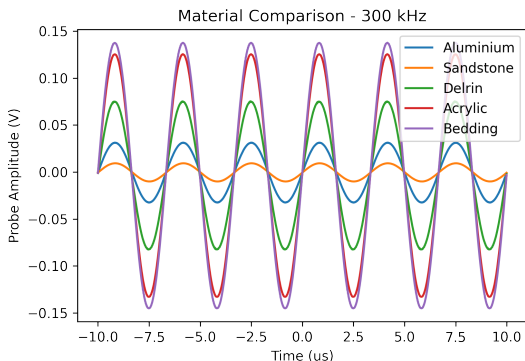
Analysis

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Data collection parameters:

- Input frequency: 100 kHz - 1 MHz
- Sample material: No sample, Sandstone, Aluminium, Tofu, etc.
- Transducers: No transducers, various P- and S-wave transducers
- Cycles (1,4, continuous)
- Sampling (collection time)



Analysis

Signal Processing

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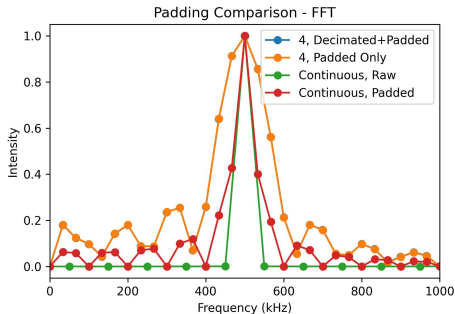
Timeline

Analyze FFT spectrum:

- Frequency Shifts
- Peak Widths
- Relative Amplitudes

After varying:

- Decimation
- Padding



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Chapter 1 - Introduction

- Motivation - Jacob's unexpected results [1]

Chapter 2 - Theory

- General Wave Physics
- Ultrasound, Piezoelectric Effect
- FFT

Chapter 3 - Materials & Methods

Chapter 4 - Results

- Control: Generator to Scope
- Frequency Shift
- Cycle & Material Comparison
- Padding & Decimation

Chapter 5 - Discussions & Conclusions

Progress

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- Data Collection - In progress
- Data Analysis - In progress

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- ✓ Course Requirements:
 - CMSC6920, P6000, P6900, MED6106
- ✓ Background Reading
- ✓ Python Review - ACENET
- ✓ Department Poster Session

Estimated Timeline

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	Task	Completion Date
Fall 2022	Data Collection	October 2022
	Data Analysis	December 2022
	First Draft/Thesis Outline	December 2022
Winter 2023	Introduction/Theory	January 2023
	Results	February 2023
	Discussions and Conclusions	March 2023
	Protocol	April 2023
	Complete Revisions	April 2023
Summer 2023	Seminar	May 2023
	Submit Thesis to SGS	June 2023
	Degree Completed	August 2023

References

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Jacob Edward Newman.

Dependence of elastic nonlinearity on aligned inhomogeneities.

PhD thesis, Memorial University of Newfoundland, 2021.

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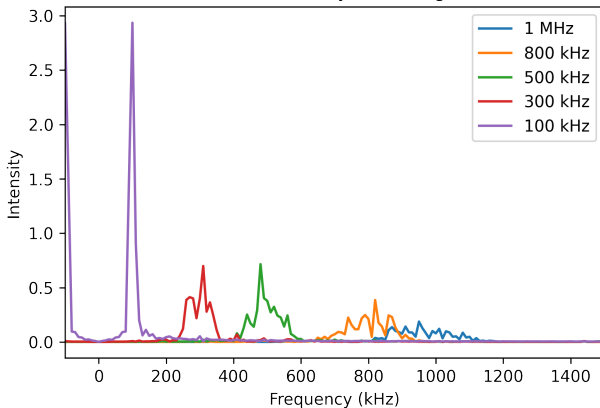
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Aluminium FFT, 4 Cycles, Longer Time



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