Canadian Association of Physicists

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Contribution ID: **3753** Type: **Poster Competition (Graduate Student) / Compétition affiches (Étudiant(e) 2e ou 3e cycle)**

(G*) (POS-35) Developing Best Practices for Elastic Wave Data Collection

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The aim of this research project is to evaluate the functionality of our instruments for performing non-linear elastic measurements and establish best practices for transient-wave dynamic acousto-elastic testing (TW-DAET). TW-DAET employs a pump and probe configuration. We perturb a sample with a low-frequency pulse (50 kHz pump), then probe the system with a high-frequency pulse (300-1000 kHz probe) to measure the non-linear effects induced by the perturbation. We focus on ultrasonic transducers and elastic wave propagation in inhomogeneous materials. This work was inspired by previous studies in geophysics, and its applications span several disciplines, such as medical physics and material science.

Previous work investigated whether the frequency of the perturbation pulse is related to the magnitude of the induced non-linear response. This work was inconclusive because the elastic wave frequency before and after propagating through the material was inconsistent. This unexpected result led us to two hypotheses: (1) the examined material possesses the capacity for frequency conversion, or (2) flaws in the experimental setup led to misleading results. To investigate these hypotheses, we conducted control experiments to establish the capabilities and limitations of our instruments. Before examining frequency conversion, it was essential to establish our setup's ability to generate and measure desired frequencies in the range of 50 kHz to 1 MHz. Using ultrasonic transducers to trigger wave propagation in various solid materials, we develop best practices and optimal operating parameters when coupling media to new samples.

The significance of this research lies in the understanding of how ultrasonic transducers couple with different materials and how this may affect non-linear elastic measurements. Although the motivation for this research lies in non-linear elasticity, these understandings apply to a diverse variety of fields. This contribution to the field of physics and instrumentation will lead to improved protocols for non-linear elastic data collection, ultimately enhancing our ability to measure and understand elastic wave propagation.

Keyword-1

Ultrasound

Keyword-2

Rock Physics

Keyword-3

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