October 2, 2020

High Coupling Efficiency Acoustic Sensing Assembly for Structural Temperature Monitoring

Presenter: Steven Snider

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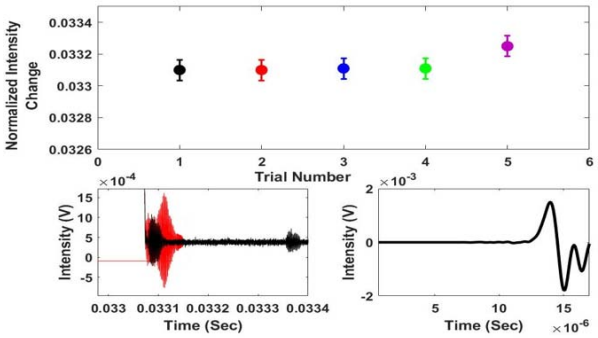
Abstract

This presentation will cover the methods taken to increase the coupling efficiency between a mass-produced 500 kHz acoustic transducer and a 1 mm fused silica waveguide core. Increased coupling into an acoustic sensing system allows for improved signal-to-noise ratios and thereby increased sensing distances. Existing sensor systems used for high temperature (1000^0C) monitoring have noted a potential drawback in the lack of a highly robust, temperature resistant mechanical connection between the waveguide and transducer. By creating a robust assembly to allow for improved coupling in high temperature and similarly extreme environments, the reliability of such distributed systems across civil, nuclear, and other tangential engineering fields can greatly improve in means of lifespan and accuracy.



(Top) Normalized intensity change per trial number, detailing the standard deviation of the repeated tests to look at repeatability. (Bottom Left) 1 mm fused silica waveguide (black) epoxied to a transducer plotted alongside the acoustic amplifier and torsion spring combined system. (Right) Numerical output generated by ABAQUS plotted over a shorter time step.

Biography

Steven Snider is a M.S. Student and started in the Spring of 2019, expecting to be completed with my research in the Fall of 2020. He is a student in Dr. Pickrell's research group that is interested in the development of distributed acoustic sensing technology for a wide range of purposes. His specific research is in the area of developing long-period fiber gratings by means of fiber diameter modification.