Optical Seismometer

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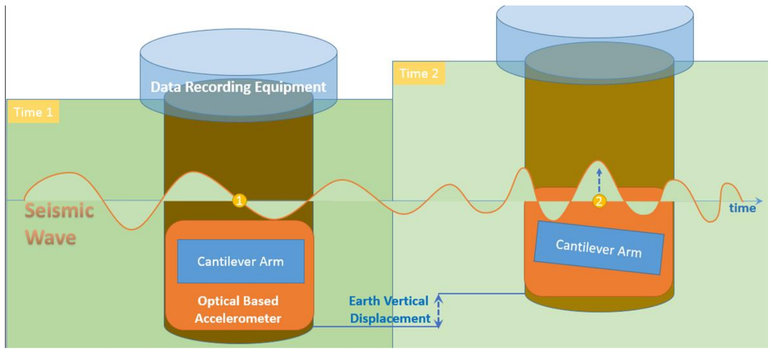
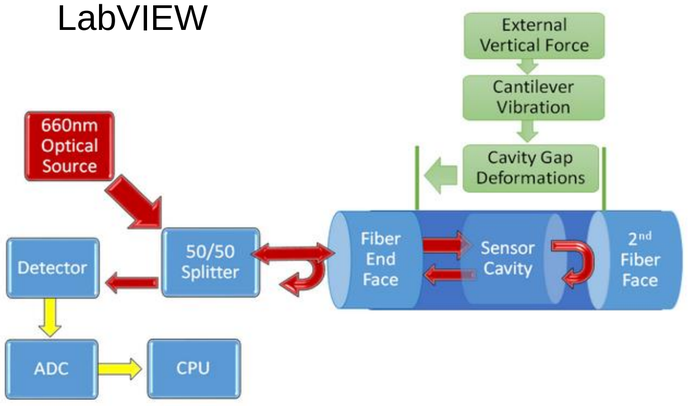
Abstract:

Seismometers are a critical part of the global infrastructure for monitoring seismic activity for a variety of applications. A cost-effective solution for seismic activity detection that will overcome conventional electro-mech seismometer limitations through design of a sensor utilizing an extrinsic fabry-perot interferometric sensing element, thereby reducing electrical noise, improving environmental hardening, and enabling future light based sensitivity enhancements.



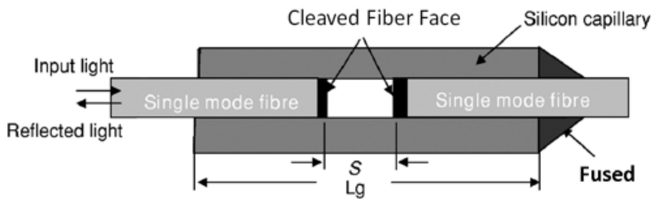
Project Description:

- Replacement for present detection network
- Mounts to 4 ½” borehole holelock
- Detect incident seismic forces
- DAQ with NI MyRIO and processing in LabVIEW



Design Specifications:

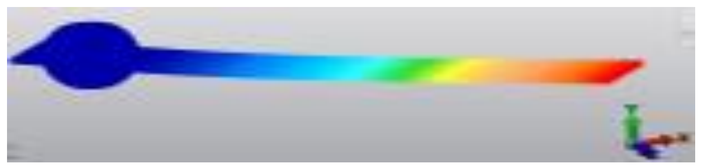
- 660 nm 20mW Laser Diode Source
- Senor Compatible with 4 ½” Borehole
- 4” x ½” x .0008” Bronze Cantilever Beam
- LabView MyRIO Data Acquisition



Fabry-Perot Cavity Diagram

Hole Lock and Sensor Mount Interface

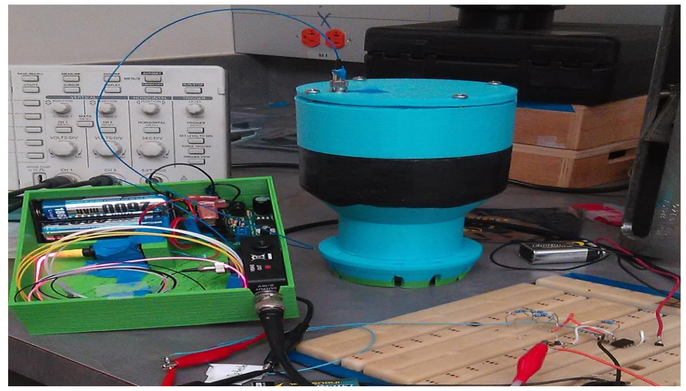
Simulation Results:



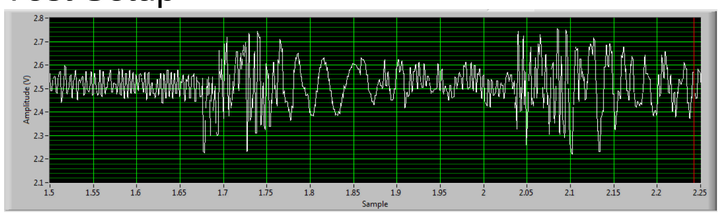
1st Order Modal Analysis

Experimental Results:

Fabry Perot Cavity



Test Setup



Data Acquired in LabVIEW

Conclusion:

A 660 nm Fabry Perot interferometer was used to prototype a new, fiber optic based seismometer to replace the existing electro-mechanical system. The simple sensor arm structure provides high sensitivity to low and high frequency components of incident waves. Further improvements to the project in the areas of physical structure(s), compensation software, and varying optical source considerations have the potential to greatly improve the sensitivity of the device and the characteristics of the response

NORTHROP GRUMMAN

Engineering & Science Student Design Showcase at Florida Institute of Technology