Clemson University Research Foundation

Integrated Sensor Instrument for Measuring Subsurface Strain (2016-004)

Measures and interprets multiple components of strain using an integrated software algorithm

Market Overview

This integrated strain sensor instrument measures multiple components of strain and deformation to provide accurate estimates of changes in subsurface materials. The energy and environment markets, specifically the recovery and storage of energy resources like oil, gas, and CO2, can be made more efficient by advancing the ability to characterize permeability and distribution of pressure, temperature, or strain. Currently available instruments, such as extensometers and tiltmeters, are used to measure horizontal and vertical changes respectively. However, they are limited in providing only one measurement of strain. Clemson University researchers have developed an integrated sensor instrument that is equipped with horizontal and vertical strain sensors, a tiltmeter, and an advanced software algorithm, allowing the instrument to measure multiple components of strain and deformation. Due to the placement of the sensors and integrated software, the instrument can provide accurate estimates of material properties and changes of pressure, temperature, and strain in the subsurface.

Application

Recovery and storage of energy resources

Stage of Development

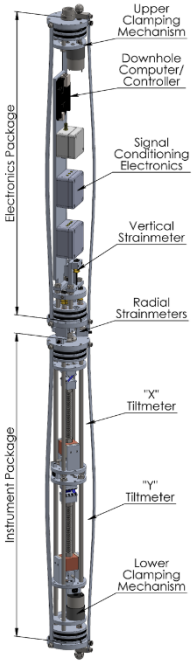
Prototype and some in-field testing completed

Advantages

- Uses multiple components to measure strain, reducing uncertainty in the interpretation
- Allows data to be obtained from shallow boreholes, requiring less drilling and reducing costs
- Allows more data to be obtained from each borehole, improving efficiency of data collection

Technical Summary

This strain sensor instrument consists of a device that is lowered into a borehole and anchored to the walls of the hole. The instrument is easily removable through the use of a registration system to securely lock the device in place before anchoring the retractable anchors. Included in the instrument are three sets of sensors for measuring: strain along the axis of the borehole, strain normal to the axis of the borehole, and vertical deformation gradient. The advanced software algorithm uses hardware that measures multiple components of strain and deformation instead and then provides accurate estimates of material properties and changes of pressure, temperature, and strain in the subsurface. This design is distinguished by its positioning of the sensors to maximize measurement accuracy and the software used to analyze the measurement data. Additional field testing of the prototype is scheduled over the next year.



For More Information Contact: Andy Bluvas | bluvasa@clemson.edu | (864) 656-5157 | CURF Reference No. 2016-004

App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Provisional	United States	62/376,476	NA	2016-004	Larry Murdoch, Stephen Moysey, Scott DeWolf

About the Inventors

Dr. Lawrence Murdoch is a Professor in the Department of Environmental Engineering and Earth Sciences at Clemson University. He earned his Ph.D. in Geology from the University of Cincinnati. Dr. Murdoch is the author of numerous publications and the recipient of several awards, including the Board of Trustees Award for Faculty Excellence and NSF CAREER Award. His research interests focus on hydrogeology.

Dr. Stephen Moysey is an Associate Professor in the Department of Environmental Engineering and Earth Sciences at Clemson University. He earned his Ph.D. in Geophysics from Stanford University and an M.S. in Hydrology from the University of Arizona. He is the recipient of numerous awards, including the NSF CAREER Grant, Hydrologic Science and Millennium TA Award from Stanford University. Dr. Moysey's research interests focus on watershed characterization and contaminant transport problems.

For More Information

To learn more about this technology, please contact:

Andy Bluvas

Technology Commercialization Officer

bluvasa@clemson.edu

(864) 656-5157