Mindfulness & Engineering: A Pathway to Divergent Thinking & Innovation

Geophysics Graduate Students

Ivan Lim: Multicomponent distributed acoustic sensing: Concept, theory and applications

Abstract: Strain measurements along the optical fiber by distributed acoustic sensing (DAS) are enticing because of their dense spatial sampling and low operation cost. However, the single component data are a poor approximation to the total strain tensor. I demonstrate solutions to obtain the full strain tensor at any location along the purposefully designed optical fiber through geometrical concepts and inversion theory. The ability to obtain multicomponent DAS data paves the way to better representation of the elastic wavefield leading to better tomography, imaging, and ultimately reservoir characterization. I introduce an imaging method for seismic source mechanism that benefits from the displacement vector and the novel strain tensor measurements. Accurate elastic seismic wavefield extrapolation requires both the displacement and stress tensor data where multicomponent strain data makes the stress observations possible. Using the same wavefield extrapolation theory, I perform accurate wavefield reconstruct from a single layer boundary on the computation domain to alleviate memory and computational requirements. I validate all proposed techniques with numerical experiments and with field datasets from the Bakken Field and the Eagle Ford shale.

Aleksei Titov: Laboratory Measurements for Geophysical Applications with Fiber Optic Sensors

Abstract: Fiber Optic Sensors measure two fundamental quantities – strain and temperature. The spatial resolution can reach 1 mm for Distributed Strain Sensors (DSS), while Distributed Acoustic Sensors (DAS) allow acquiring data with much higher rates (up to 100 kHz) and provide pico-strain accuracy. In this presentation, we will focus on laboratory applications of DAS and DSS. In the first part of our lecture, we will understand how different types of sensors work, what are the main challenges and benefits in using them. In the second part, we will focus on laboratory experiments undergoing at Mines and their results: flow-profiling, pressure and strain sensing. We will highlight the value of laboratory experiments and how they are used to understand better field data from Oil & Gas Industry, Environmental and Engineering Geophysics.

4:00 to 5:00 Wed March 13th
Coolbaugh 209
Reception 3 to 4 GRLA Annex