Bay Area Geophysical Society Seminar Series

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Monitoring Fracture Dynamics During Well Stimulation: DAS, Permanent Sources, and Automated Classification

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Abstract: Capturing and characterizing the full fracture lifecycle during well stimulation remains a significant challenge in geomechanics and subsurface monitoring. We present an integrated monitoring framework that combines distributed acoustic sensing (DAS) with surface orbital vibrators (SOVs) for continuous, high-temporal-resolution tracking of fracture seismic response, alongside a machine learning framework for automated classification of fracture dynamics from low-frequency DAS (LF-DAS) strain rate data. The SOV/DAS methodology enables repeated time-lapse vertical seismic profiling (VSP) during active stimulation, resolving key stages of the fracture lifecycle, from initiation, opening, to closure, as well as highlighting activations linked to hydraulic connectivity with natural fracture networks. Complementing this, we are developing a supervised convolutional neural network framework to perform multi-class discrimination of co-occurring geomechanical signals in LF-DAS data, including new hydraulic fractures, reactivated fractures, and strike-slip fault events. Accurate, near-real-time identification of the latter is critical for well integrity, as shear displacement along faults can cause costly casing damage. Together, these tools advance our ability to monitor, classify, and ultimately predict fracture dynamics during hydraulic stimulation operations.

Dr. Correa is a Research Scientist in applied geophysics in the Energy Geosciences Division in the Lawrence Berkeley National Laboratory. Her research is focused on developing alternative cost-effective long-term monitoring solutions using fiber-optics sensing and permanent seismic sources, with applications ranging from carbon storage, unconventional reservoirs, to geothermal. Additionally, she leads the Geosciences Measurement Facility at the Earth and Environmental Sciences Area, which specializes in custom-designed sensors. She received her PhD in Exploration Geophysics from Curtin University, Australia, with research focused on using distributed acoustic sensing (DAS) for seismic imaging and monitoring applied to the Otway Project. Before that, she worked as a Field Geophysicist with seismic acquisition and processing in a seismic vessel at Schlumberger. She received her BSc in Geophysics from Fluminense Federal University, Brazil.

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