PCSEG – Bakersfield September 5 – Lunch Presentation

Title:

Distributed Acoustic Sensing utilizing “dark” telecom fibers – observations from the Stanford Fiber-optic Seismic Observatory and other infrastructure installations

Abstract:

Fiber-optic Distributed Acoustic Sensing (DAS) uses laser light to measure the strain in the fiber due to external forces. We introduce briefly the basic principle of DAS sensing. While dedicated-purpose installations within boreholes are more common, the use of unused “dark” fiber that is incidentally available in telecom installations is less so. To measure subsurface strain reliably, there needs to be good coupling of the surrounding material to the fiber cable. Permanent borehole installations or permanent surface-trenched fiber cables exhibit in general good coupling. In contrast, telecom fibers tend to be spatially variable in coupling behavior, yet still can yield useful strain measurements. We discuss Stanford’s Fiber-optic Seismic Observatory as an example where a standard telecom fiber-optic cable was installed in subsurface ducting on campus and monitored continuously over 2 years for ambient noise as well as earthquake activity. Pipelines often have dedicated fiber-optic communication links along them whose dark fibers can be used to record the strain field caused by external sources. Typical applications could be intrusion or leak detection, as well as generating alerts due to large ground motions, so that facilities can safely be shut-down automatically. We show an example of fiber along a pipeline that recorded Mexico’s large earthquakes in 2017 along its entire with a high density of “virtual sensors”. Telecommunication fibers are buried in many places for a variety of purposes and present excellent opportunities for a multitude of Distributed Acoustic Sensing applications.