HypoSensor Deep Borehole Accelerometer

CASE STUDY

Forced Balance Accelerometer in Extreme Locations for Seismic Monitoring on Dams

Technical Proposition: The seismic monitoring of dams often presents unique implementation challenges. What is the best way to embed a high-resolution accelerometer deep in the dam structure? How do engineers get better depth control of induced earthquakes? How does an organization manage installation for a structure when boreholes are wet?

Kinemetrics' HypoSensor accelerometer is the answer. The HypoSensor is a triaxial downhole package for deep borehole installations. The unit consists of three benchmark EpiSensor accelerometer modules mounted orthogonally in one small waterproof stainless-steel cylinder only 75mm (3") in diameter allowing deployment in thin postholes/boreholes which are much less expensive to drill.

Technical Specifications: The HypoSensor's specifications speak for themselves. With full-scale recording ranges of ± 0.25 to ± 4g, the HypoSensor provides an on-scale recording of earthquake motions even at near-fault locations. The significant bandwidth of DC to 200 Hz allows engineers and scientists to study motions at higher frequencies while maintaining the important DC response that allows simple field calibration and reduces post-processing confusion. The flexible output circuitry allows four user-selectable types: ± 2.5V single-ended, ± 10V single-ended, ± 5V differential, or ± 20V differential, permitting to connect a wide range of digitizers.

The very-low self-noise puts the FBA in the 155-dB dynamic range. In addition, low non-linearity, hysteresis, cross-axis sensitivity, and thermal drift are features that take full advantage of the dynamic range.

Designed for use in real-world situations, the HypoSensor package is waterproof to 700 m depth and comes with double-stage transient protection, an internal compass option, and custom cable lengths.

Kinemetrics KMIDam Solution: The KMIDam platform utilizes the HypoSensor whenever ideal locations are sought out to improve on the hypocenters of induced seismic events or enhance structural monitoring. For the latter, dynamic measurements at critical but difficult to access locations augment key input data for digital twins, a technology which is also supported by KMIDam's data acquisition and processing platform.

Conclusion: As with other Kinemetrics solutions, the HypoSensor is not just a high-quality instrument, but brings along with it Kinemetrics' 50+ years of experience. You can trust the HypoSensor to provide simplified installation even in extreme conditions, support your dam safety initiatives, and most importantly record the earthquake faithfully; after all, earthquakes cannot be repeated.