Monitoring the Performance of Geotechnical Structures Using Sensor Arrays

Ensuring the performance and safety of geotechnical structures increasingly relies on continuous, data-driven monitoring. Advances in sensor array technologies—from conventional instrumentation (e.g., Shape Arrays, Time Domain Reflectometry) to distributed fiber-optic systems (e.g., Distributed Temperature Sensing and Distributed Acoustic Sensing)—now enable high-resolution, real-time assessment of deformation, strain, scour, dynamic responses, system degradation, and material properties. This presentation reviews the field deployment and interpretation of these sensor arrays, emphasizing their role in tracking structural performance, detecting early signs of distress, and enhancing site characterization. Case studies include applications in embankment monitoring, deep foundation assessment, dynamic process evaluation, and near-surface property characterization. Practical considerations—such as sensor placement, data interpretation, management, and long-term performance—are also discussed. The findings demonstrate how integrated monitoring systems can improve the reliability, resilience, and decision-making processes of geotechnical infrastructure