Analytical Model of In-Situ Root-Inspired Ground Anchor Actuation and Pullout

Root-inspired ground anchors are an emergent bio-inspired geotechnical ground anchoring technology leveraging the pullout resistance efficiency of fibrous plant root systems. These anchors are a technologically feasible means to construct root-like anchor geometries in-situ using conventional ground anchor construction techniques and equipment: a ferrous linkage mechanism alters its configuration in-situ from cylindrical to root-like and remains fixed in the latter configuration by cured cement grout. This technology currently lacks a means to estimate forces on the linkage mechanism during in-situ actuation, and thus, mechanism design and size limitations are poorly understood. A reliability-based design procedure and Monte-Carlo simulation software are presented which implement an analytical estimate of the forces on root-inspired ground anchors during actuation in-situ and an analytical pullout capacity prediction method. Design examples are presented along with software outputs and discussion of the assumptions and limitations of the methodology.