

Artificial Intelligence in the Design of a Retaining Structure

Authors : Kelvin Lo

Abstract : Nowadays, numerical modelling in geotechnical engineering is very common but sophisticated. Many advanced input settings and considerable computational efforts are required to optimize the design to reduce the construction cost. To optimize a design, it usually requires huge numerical models. If the optimization is conducted manually, there is a potentially dangerous consequence from human errors, and the time spent on the input and data extraction from output is significant. This paper presents an automation process introduced to numerical modelling (Plaxis 2D) of a trench excavation supported by a secant-pile retaining structure for a top-down tunnel project. Python code is adopted to control the process, and numerical modelling is conducted automatically in every 20m chainage along the 200m tunnel, with maximum retained height occurring in the middle chainage. Python code continuously changes the geological stratum and excavation depth under groundwater flow conditions in each 20m section. It automatically conducts trial and error to determine the required pile length and the use of props to achieve the required factor of safety and target displacement. Once the bending moment of the pile exceeds its capacity, it will increase in size. When the pile embedment reaches the default maximum length, it will turn on the prop system. Results showed that it saves time, increases efficiency, lowers design costs, and replaces human labor to minimize error.

Keywords : automation, numerical modelling, Python, retaining structures

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