Chapter 5

Conclusion

The present study proposes an ant colony optimization algorithm for locating the critical failure surface in slope stability analysis. Equilibrium equations are derived by considering both force and moment equilibrium using the Morgenstern-Price method for a variety of slope geometries and loading conditions. The resulting nonlinear equations from the Morgenstern-Price method are solved by the Newton-Raphson method. This way, the numerical strength of the Newton-Raphson method and the optimizing capability of the heuristic ACO are both effectively utilized. This study represents slip surfaces as piecewise-linear curves. Relative angles between adjacent linear segments are used as parameters that represent slip surfaces. In this way, it is possible to include only kinematically admissible and physically acceptable curves in the search space, which results in greatly increased computational efficiency. The presented ACO algorithm can be easily applied to quickly locate the critical failure surface with the lowest factor of safety. The method requires a simple form of the objective function, which is a function of the factor of safety. Hence, it is simple in structure and easily programmable in any computer language.

The results of this study also suggest that the present searching method can be used to analyze the stability of a wide range of geotechnical problems with homogenous layer or multilayer geology. The option to include the effects of a surcharge load and pseudo-static horizontal and vertical loading due to earthquake is included in the derivation of the limit equilibrium equations. This enables a comprehensive evaluation of the slope stability where these loads may exist in actual site conditions. Based on the results obtained from this study, the proposed method consistently gives satisfactory results. This is because the proposed algorithm is not bounded by constraints related to the position and shape of the critical failure surface.