

Complex function model for foundation pit sloping excavation, considering stress interaction between dense karst caves in underground space

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Absrtact: Excavating and supporting foundation pits in karst areas are difficult tasks in geotechnical engineering. The geological conditions in dense karst cave areas are complex, and current karst cave evaluation methods consider the only single factor. Therefore, the foundation pit evaluation results exhibit a low safety factor that increases the cost of foundation pit excavation and support, thus, hindering the development of an economical and reasonable foundation pit-sloping excavation model. Therefore, this study focuses on the complex function method to investigate the law of stress interactions between dense karst caves. The Riemann mapping theorem was used to simplify the boundary points and establish an analytical solution for the stress interaction between arbitrary karst caves. Based on the characteristics of the stress interaction between karst caves, stability calculation methods for dense karst cave pits and relevant discriminatory criteria are proposed for different crack angles. Furthermore, the aforementioned complex function analysis method was used to develop a foundation pit-sloping excavation model for a dense underground karst cave area. The findings of this study were applied to a dense karst cave project in South China. The calculation results of this study are identical to the numerical results and the actual situation of the project. This demonstrates the practicality of the analysis method and criterion and the feasibility of the slope release excavation model.

Keywords: Dense karst caves; Stress interaction between karst caves; Foundation pit sloping excavation; Complex function model