

孔径変化法による初期応力測定装置の性能試験

PERFORMANCE EVALUATION TEST OF INITIAL STRESS MEASUREMENT BASED ON BOREHOLE DEFORMATION METHOD

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初期応力測定装置の外観と室内実験状況

概要

山岳トンネルでは、特殊な設計条件の場合や、施工中あるいは供用後に変状が発生した場合、FEMなどの数値解析を用いた設計・検討がなされている。その際、トンネル周辺岩盤の応力状態が解析結果に大きく影響することから、トンネル周辺岩盤の初期応力測定を行うことが望ましいが、実際に測定した事例は少ない。本報告では、筆者らが開発中の初期応力測定装置の精度検証のために、岩石ブロックを用いた載荷試験を行った。測定値と理論解を比較した結果、定量的な評価の面で課題が残ったが、再現性がある測定が行えており、定性的には理論値とよく一致した。また、今回の試験条件において結果に影響を与える因子を検討した結果、周方向変位の角度による対称性を正しく取得することが最も重要であることが分かった。

Numerical analysis such as the finite element method (FEM) has frequently been applied to design tunnels under special design conditions or when deformation occurs. Since the initial stress state of rock mass around the tunnel greatly affects the analysis results, it is desirable to measure the initial stress around the tunnel. However, there are a limited number of application examples of measuring initial stress for tunnel engineering projects. In this paper, the authors conducted a series of loading tests using a sandstone block to verify the accuracy of the initial stress measurement device based on the borehole deformation method. It was ensured that good reproducibility of the developed stress measurement device can be achieved. Then, a comparison of the measured stress components against the applied stress indicated that the measurements show qualitatively good performance, although there remain some issues to be improved in terms of quantitative performance. To aim for better performance, a theoretical solution was utilized to elucidate the most significant factor that influences the evaluated stress components. The results showed that the most significant factor for better quantitative performance is to achieve the correct symmetry of the measured circumferential displacement with respect to the angle associated with the borehole wall.