Inverse analysis for the convergence-confinement method in tunneling
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Abstract

For the safety of tunnel excavation, the observation of tunnel convergence not only provides a technique for assessing the stability of the surrounding ground, but also provides an estimate of the constitutive parameters of geological materials. This estimation method belongs to an inverse algorithm process called the inverse calculation method (ICM), which utilizes the incremental concept in the convergence-confinement method (CCM) to solve the support-ground interaction of circular tunnel excavation. The method is to determine the mathematical solution of the intersection of the two nonlinear curves, the support confining curve (SCC) and the ground reaction curve (GRC), in the CCM by using Newton’s recursive method and inversely calculating the unknown parameters. To verify the validity of the developed inverse algorithm process, this study compares the results of the ICM with those of the published articles. In addition, the modulus of rock mass and unsupported span are inversely deduced using the values of convergence difference measured in the practical case of railway tunnels.

Keyword: Inverse problems; inverse calculation method; tunnel analysis; convergence-confinement method; support-ground interaction; Newton’s recursive method