# A comparison between compression and impression creep techniques using finite element method

**F.S. Rassouli[1], M.H. Mehranpour[2], M. Moosavi[3]**
*[1]Graduate student of Tehran University, [2]Graduate student of Tehran University, [3]Professor of Tehran University*
Corresponding author's e-mail: fsrassouli@yahoo.com

## ABSTRACT

Creep is a rate dependent material nonlinearity in which the material continues to deform under a constant load. In a traditional theory, creep could be divided into three stages. Impression creep technique is a novel creep test in which a flat ended cylindrical punch penetrates into a small region of sample with a constant load. One of the attractive features of the impression creep test is its ability to establish steady-state creep condition within very short times for soft materials. Although this method had been used for ceramics before, but recently some researchers have applied this new kind of test on soft rocks too. The results were in a good agreement with the result of creep parameters achieved by conventional creep tests.

Computational simulation has been commonly employed to analyze the impression creep conditions for different materials since analytical solutions for many impression creep problems do not exist. In this study, a commercial finite element method (FEM) software, Ansys™, is used to model both compression and impression creep tests based on creep parameters that are obtained from some laboratory conventional compression tests. The creep parameters resulted from the simulated impression tests will be compared with the results of impression creep parameters in the laboratory tests.

The ANSYS program has the capability of modeling the first two stages (primary and secondary). The tertiary stage is usually not analyzed since it implies impending failure. The implicit creep procedure is used in modeling the impression and compression test. And the creep model can be described by Norton's law:

$$\dot{\varepsilon}_{cr} = C_1 \sigma^{C_2} e^{-C_3/T}$$

2-D 4-Node Structural Solid axisymmetric elements are used to model the creep tests. In the impression model, the indenter contains 270 elements, the plastic region located under the indenter contains 1156 elements and the remain region contains 1742 elements. The indenter has 3mm diameter with higth of 4mm. Figure 1 shows element structure of impression model.

**Keywords: Impression creep, compression creep, creep parameters, finite element method, Ansys™.**

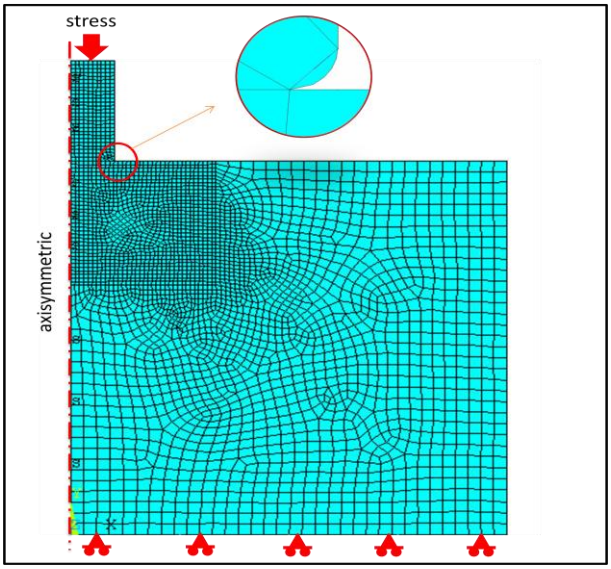

Figure 1: Construction of elements in impression creep test