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Modeling viscoelastic deformation of the earth due to surface loading by commercial finite element package - ABAQUS

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Wu (2004) developed a transformation scheme to model viscoelatic deformation due to glacial loading by commercial finite element package - ABAQUS. Benchmark tests confirmed that this method works extremely well on incompressible earth model. Bangtsson & Lund (2008),however, showed that the transformation scheme would lead to incorrect results if compressible material parameters are used. Their study implies that Wu's method of stress transformation is inadequate to model the load induced deformation of a compressible earth under the framework of ABAQUS. In light of this, numerical experiments are carried out to find if there exist other methods that serve this purpose. All the tested methods are not satisfying as the results failed to converge through iterations, except at the elastic limit. Those tested methods will be outlined and the results will be presented. Possible reasons of failure will also be discussed.

Bängtsson, E., & Lund, B. (2008). A comparison between two solution techniques to solve the equations of glacially induced deformation of an elastic Earth. International journal for numerical methods in engineering, 75(4), 479-502.

Wu, P. (2004). Using commercial finite element packages for the study of earth deformations, sea levels and the state of stress. Geophysical Journal International, 158(2), 401-408.