An analytical solution of plane strain consolidation due to a point sink within a fluid-saturated poroelastic media

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Abstract An analytical solution was derived for the general Biot’s consolidation theory within a finite two-dimensional (2-D) poroelastic media due to a point sink/source when the pore pressure is prescribed on the boundary. Appropriate Fourier and Laplace transforms and the corresponding inversions were implemented to obtain the exact solution. In particular, the steady-state analytical solution due to a point sink of constant production rate was presented and validated by the exact solution available in the literature. The proposed analytical solution in this paper is highly applicable for testing the accuracy of numerical schemes, and also can be of great use to further investigate the behaviour of flow and deformation coupling in a finite 2-D domain.

Key words finite 2-D poroelastic media; plane strain consolidation; finite sine and cosine transforms; analytical solution