

# Elastic Solutions for a Saturated Isotropic Half Space Subjected to a Fluid Line Sink

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## Abstract

The study derives the closed-form solutions of the long-term elastic consolidation subjected to the fluid line sink in a homogeneous isotropic elastic half space aquifer. The Hankel transform in a cylindrical coordinate system is employed to develop the analytical elastic solutions. Derivations of governing equations are based on the mathematical model of Biot's theory of poro-mechanics, and the half space aquifer is modelled as a saturated porous stratum which is bounded by a horizontal surface. The total stresses of the aquifer obey Newton's second law and Hooke's law. Besides, the mass conservation and Darcy's law are introduced to formulate the governing equations of pore fluid flow. The software Mathematica is used to complete the symbolic integrations and obtain the closed-form solutions. The solutions can be applied in dewatering operations of compressible aquifer.

Keyword : Fluid line sink, Closed-form solution, Half space, Porous medium