

IMPULSIVE POINT SINK AND INSTANTANEOUS POINT HEAT SOURCE INDUCED RESPONSES
OF A HALF SPACE

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Abstract

Thermoelastic deformation due to an impulsive point heat source is the analog of poroelastic response caused by an impulsive point sink. In this paper, Biot's three-dimensional consolidation theory is introduced to derive the analytical solutions of the elastic transient consolidation deformation with an impulsive point sink in saturated isotropic poroelastic half space. The transient ground surface displacement produced by an impulsive point heat source is described through analog quantities between poroelasticity and thermoelasticity. Closed-form solutions of the horizontal and vertical displacements are obtained by using Laplace and Hankel integral transforms. Attention is focused on the maximum surface horizontal displacement compared to the maximum surface settlement. Results show that the horizontal displacement is around 38.5% of the maximum ground surface settlement. The study concludes that horizontal displacement is significant, and it should be considered in the prediction of transient settlement induced by groundwater withdrawal.

Keyword : Mathematical Modelling, Half Space, Point Sink, Point Heat Source