Golden Ratio in the Point Heat Source Induced Horizontal and Vertical Displacements of an Isotropic Elastic Half Space

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Abstract

Based on three-dimensional thermoelasticity, the homogeneous isotropic stratum is modelled as a linear elastic half space. Analytical solutions of the transient and long-term horizontal and vertical displacements due to a point heat source are presented. Utilizing Laplace and Hankel integral transforms, the closed-form solutions of displacements of the ground surface are obtained. The displacements affected by thermally parameters are illustrated and discussed. The maximum ground surface horizontal displacement can be exactly derived, and it is around 30% of the maximum ground surface vertical displacement. Moreover, the golden ratio, known as = 1.618, appears in the maximum ground surface horizontal displacement and corresponding vertical displacement of a half space. The study concludes that golden ratio emerges in this phenomenon and the horizontal displacement should be properly considered in the prediction of vertical displacement induced by a buried heat source.

Keyword：Golden Ratio, Point Heat Source, Half Space, Closed-form Solution