

Dynamic Behavior of a Saturated Poroelastic Soil Layer Subject to Surface Disturbance

Ping-Cheng Hsieh^[1]

ABSTRACT In order to reveal the importance of the viscous effect on the dynamic response of a fluid saturated poroelastic soil layer of finite thickness when subjected to periodical motion, say oscillatory surface disturbances, viscosity of water is considered herein. Homogeneous water is governed by the theory of viscous fluid flow and the poroelastic soil obeys Biot's poroelastic theory. The governing equations of the soil layer are decoupled into four Helmholtz equations without losing physical generality. The proposed boundary value problem is solved by a semi-analytical algorithm of which twelve undetermined coefficients of the general solutions must be obtained simultaneously. The results are compared with those obtained by potential model, and compared with those of poroelastic soil layer of infinite thickness to show the impermeable rigid boundary effect.

Key Words: pore water pressure; effective stress; viscous model; boundary effect.

受表面干擾之飽和孔隙彈性土層的動力行為

謝 平 城^[1]

摘 要 為揭露流體黏滯度的重要性,本文將水的黏滯性納入考量,進行探討一有限厚度的飽和土層承受一週期運動時(如震盪的表面干擾),所產生的動力反應。文中均質水體由黏性流理論所主控,而孔隙土壤則由 Biot 孔隙彈性介質理論主控。土層的控制方程式可被拆解成四個 Helmholtz 方程式而不失其物理通性。此一邊界值問題係以一半解析的方式同時求出其通解中的十二個待定係數,所得之解與勢流模式相比較,並且與無限厚度土層的結果亦進行比較,以顯示不透水剛性邊界效應。

關鍵詞: 孔隙水壓力、有效應力、黏流模式、邊界效應。