# CHAPTER II

# LITERATURE REVIEWS

The fundamental work related to the load transfer from a cylindrical elastic inclusion of infinite length to an elastic medium was first examined by Muki and Sternberg (1969). Muki and Sternberg (1970) later investigated the problem of an axially loaded elastic bar of finite length and circular cross section embedded in bonded contact with an elastic half-space. This investigation is based on the assumption that the bar behaves as a one-dimensional elastic continuum. Keer and Freeman (1970) considered the elastostatic load transfer of a torque from an infinite cylindrical bar into the surrounding half-space. Karasudhi *et.al.*(1984) extended the scheme of Muki and Sternberg (1970) to study a torsion problem in a layered elastic half-space.

The exact analytical formulation for the problem of a finite elastic bar involves several fundamental difficulties. However, elegant analytical formulations based on coupled singular integral equations exist for elastostatic axisymmetric problems of a finite rigid bar (Luk and Keer, 1979, 1980 and Luco, 1976). Poulos and Davis (1968) and Suriyamongkol *et.al.*(1973) studied the behavior of axially loaded rigid cylinders using an efficient semi-analytical method based on a discretization procedure. In this method, a homogeneous half-space subjected to unknown tractions along a fictitious contact surface is considered. The intensities of these tractions are determined by enforcing an appropriate rigid body displacement at discrete locations of the fictitious contact surface.

In the context of elastodynamics, vertical vibrations of an elastic bar embedded in an elastic half-space were considered by Flowler and Sinclair (1978), Rajapakse and Shah (1987) and Rajapakse (1988). A boundary integral equation method was employed by Apsel and Luco (1987) to study dynamic response of foundation embedded in elastic half. In this method, the solution to a given boundary value problem is reduced to the determination of intensities of forces applied on an auxiliary surface defined interior to the real contact surface where the boundary conditions are specified. A coupled set of integral equations is established to determine the intensities of forces applied on the auxiliary surface. The integral equations are solved by discretization and reduction to a system of linear algebraic equation. Comparison with existing result for rigid cylindrical foundations was also presented.

It is well known that fully saturated soils are naturally two-phased materials consisting of soil gains and water. Biot (1941) developed a 3D theory for fluid-filled elastic porous solids. An elastodynamic theory was later presented by Biot (1956) for saturated porous media by adding the inertia terms to his quasi-static theory (Biot, 1941). Niumpradit and Karasudhi (1981) investigated the quasi-static behavior of a vertically loaded cylindrical elastic bar partially embedded in a homogeneous poroelastic half-space with incompressible constituents by adopting Muki and Sternberg's schemes. The quasi-static bending of an elastic bar in a homogeneous poroelastic half-space was also studied by Apirathvorakij and Karasudhi (1980). Rajapakse and Senjuntichai (1995) presented an indirect boundary integral equation method for the analysis of boundary value problems related to infinite and semi-infinite poroelastic media. Recently, Zeng and Rajapakse(1999b) considered the time-harmonic response of an axially loaded elastic bar embedded in a poroelastic medium, in which the bar is assumed to be one-dimensional. Such assumption is valid for a situation where the length to diameter of the bar is comparatively large. In their study, the contact surface between the bar and the poroelastic half-space is assumed to be fully permeable. A review of literature indicates that the dynamic interaction between a rigid cylinder and a poroelastic half-space by considering the effect of hydraulic boundary conditions has never been studied in the past.