CHAPTER I

INTRODUCTION

1.1 General

The study of soil-structure interaction problem is of considerable importance for both structural and geotechnical engineering. The results obtained from this problem are very useful for the analysis and design of foundations as well as for the analysis of stresses and displacements in the soil medium. For example, the model of a rigid cylindrical body embedded in a soil medium under dynamic excitations (e.g. vibrating machines, seismic waves, etc.) can be used in the analysis and design of piles or caissons as well as circular footings, and theoretical modeling of some in situ testing methods.

During the last 40 years, a lot of researchers have studied the dynamic soil-structure interaction problem by employing a variety of analytical methods, such as integral transform methods, power series, Fourier series techniques and variational methods, and also numerical methods such as Finite Element method (FEM) and Boundary Element method (BEM).

Most existing studies on dynamic soil-structure interaction problems have considered a soil medium as an elastic half-space. However, a soil medium is generally a two-phased material consisting of a solid skeleton with voids filled with water. Such material is commonly known as a poroelastic material and widely considered as a much more realistic representation for natural soils and rocks than an ideal elastic material.

In this thesis, the problem of a circular rigid cylinder embedded in a poroelastic half-space subjected to time-harmonic vertical loading as shown in Figure 1.1 is considered by employing an indirect boundary integral equation method. A computer program has been developed to solve this interaction problem and to investigate the influence of various parameters on the dynamic response of the cylinder.

1.2 Objectives of Present Study

The objectives of this thesis are

1) To develop a computer program based on an indirect boundary integral equation to study vertical vibrations of a rigid circular cylinder in a homogeneous poroelastic half-space.

2) To investigate the effect of various parameters, e.g., geometry of cylinder, poroelastic material properties, frequency of excitation and hydraulic boundary condition on the cylinder response.

1.3 Scope of Present Study

This study are based on the following assumptions

1. The cylinder is assumed to be perfectly rigid.
2. The half-space is a homogeneous poroelastic medium and governed by Biot's poroelastodynamic theory.
3. The cylinder surface is assumed to be either impermeable or fully permeable and perfectly bonded to the surrounding half-space.
4. Only an axisymmetric time-harmonic vertical loading is considered in this thesis.

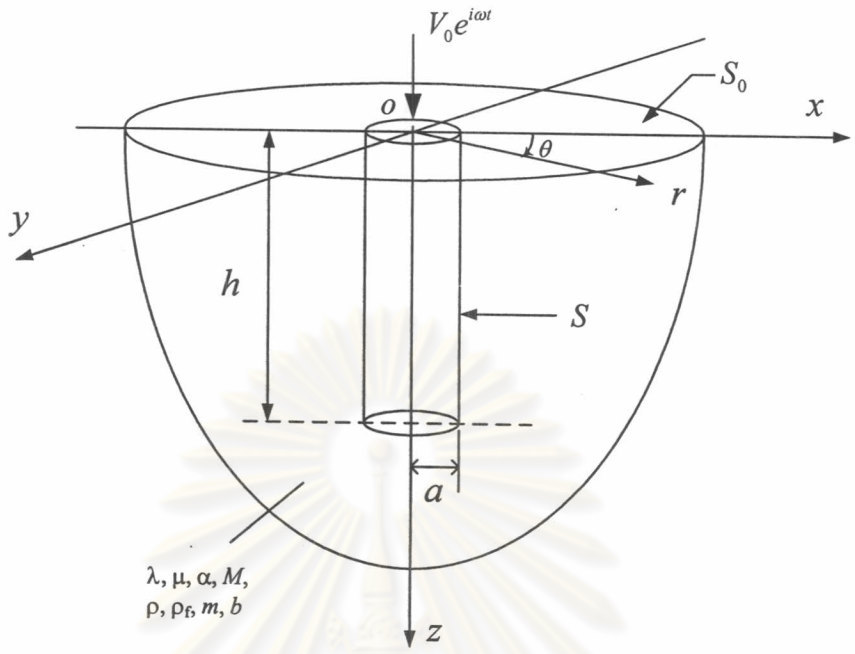

Figure 1.1 Geometry of rigid cylinder embedded in poroelastic half space