The propagation of mechanical disturbances in solids is of interest in many branches of the physical sciences and engineering. This dissertation presents an account of wave propagation in elastic and poroelastic solids.

Chapter 1 of this dissertation is an introduction to elastic and poroelastic fields. The fundamental concepts of elastic and poroelastic are presented and the basic field equations are derived. It includes the Green's Dyadic, which is found to be a useful tool to solve three dimensional problems in elastic media and in this chapter we also deal the Helmholtz equation. The solutions for the scalar Helmholtz equation in an infinite medium and a slab are derived. Emphasis is laid on the Green's Dyadic for a vector Helmholtz equation. The symmetry of the Green's Dyadic is proved. We also deduce the Green's function for a vertically Inhomogeneous Halfspace.

Chapter 2 investigates a problem of potential interest to geophysicists. Namely, we attempt to find the shape of a magma chamber lying in the earth's crust below a volcano. This is posed as an inverse acoustics problem where we use scattered seismic waves to determine the location and form of the chamber. A simplification is to consider the finite crust to be over a semi-finite magma region. An earlier work of ours discussed the inverse problem associated with the Perkeris model [50]; whereas, in the present work the crust with volcano is represented as a perturbation of this model. In order to reformulate this inverse problem in integral equation form, we first construct the Green's function for the region without a chamber. A numerical example is presented for the case of the bump being a half circle. We also solve the direct and inverse problems with jump condition for two materials of different densities.

Chapter 3 is devoted to the Green's Dyadic for the elastic layer with an acoustically interacting half space, a problem related to the seismological investigation of a volcano over the earth's crust. We derive the Green's Dyadic in a elastic layer on top of an acoustic half-space. Consider a time-harmonic, point-source in a homogeneous elastic layer of height h, lying over an acoustic half-space. On the elastic and fluid interface, both reflection and transmission of the elastic energy occurs, that is, a portion of the energy leaves the elastic layer and enters the acoustic field.

Chapter 4 focuses on the Biot's equations for the elastic case. The expansion of displacements in terms of symmetric modes and antisymmetric modes are derived. Later in the chapter, the orthogonality for the Rayleigh-Lamb modes are proved.

Chapter 5 renders a comprehensive study of Biot's equations for poroelastic materials. Hence we include a discussion of the decomposition of the waves, the dispersion relations for the Lamb modes, the summarization of symmetric and antisymmetric modes. It also includes the proof for the orthogonality of the modes.

Chapter 6 is about the Green's Dyadic for the elastic slab with a free boundary condition and we investigate the direct and inverse scattering problem. We also deduce the variation of the Green's Dyadic. By calculating the gradient of Green's Dyadic, we eventually have the representation as a Hadamard variational representation.