

Chapter 8

Seismic Analysis

ABSTRACT

An earthquake is caused by sudden motion of the earth's crust. Every year, tens of thousands of earthquakes of all sizes occur all over the world. Some cause tiny or major tremors, others occur in remote areas where no one lives. This chapter allow readers to find out more about the earth structure as well as earthquake nature. Therefore, to detail the definition and construction of a spectrum, a presentation of earthquake analysis is given. In order to become familiar with this analysis, two applications are presented at the end of the chapter with a detailed solution.

INTRODUCTION

The structural support motion represents another form of solicitation; in which the study constitutes the subject of this chapter, which allows us to shed light on the so-called seismic study. Before we get to the heart of the subject, we will first outline some points, namely the earth structure, the causes of an earthquake, the definition and construction of a spectrum.

The study of the response of structures to earthquakes is the most widely used application of structural dynamics in civil engineering. The main reason is that earthquakes generate large forces of inertia for the vast majority of buildings and civil engineering structures. Earthquakes remain the dominant dynamic excitation mode.

EARTH STRUCTURE

The earth is composed of four layers see figure 1, the crust, the mantle, the outer core and the inner core.

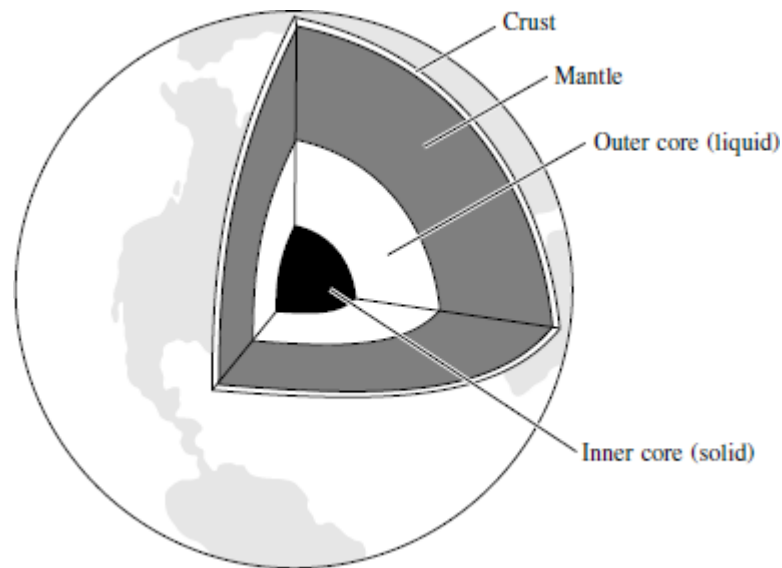
A brief definition of each layer is presented as follows:

Crust: the crust is the outer layer of hard rock; whose thickness varies from 4 to 60 kilometers.

Inner Core: The inner core with a radius of 1.37 km is considered as a Solid metal body.

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Figure 1. Earth structure (Clough & Penzien, 1995)



Crust: The crust is the layer below the mantle and is made of dense rock, a thickness of 2900 kilometers. The upper layer of the mantle is called the lithosphere; which is 100 kilometers thick and quite rigid. There is a soft layer below called asthenosphere that is 400 kilometers thick.

Outer core: The outer core is a 2000-kilometer thick layer that is considered a layer of liquid metal. These different layers are distinguished from each other by variations in the wave propagation speed.

EARTHQUAKES CAUSES

Earthquakes can be caused by natural events or human activities. Here are some of the different causes of earthquakes:

Tectonic Plate's Motion

This is the most common cause of earthquakes. The earthquake occurs when the pressure that has accumulated in the tectonic plates causes a sudden rock break. This usually occurs within the boundaries of tectonic plates and along existing faults.

Volcanic Activity

The flow of magma can cause earthquakes; a volcanic eruption is often accompanied by small shakes just before, during and after the eruption. Deep below the volcano's orifice, the hot magma moves slowly through subterranean passages, exerting pressure, and trying to make its way to the surface of the earth. When this happens, the surrounding rock is pressurized by the magma thrust. This causes fractures of the rock so small earthquakes that occur.

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