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# On the Characteristics of Ground Motion and the Improvement of the Input Mode of Complex Layered Sites

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**Abstract**

It is a hot research topic to perform the dynamic interaction analysis between the engineering structure and the soil by using the time-domain method. This paper studies the seismic behaviour of the layered sites and the seismic response of the structures using the viscous-spring artificial boundary theory. The artificial boundary model of viscous-spring is initially based on homogeneous foundation. For the layered site (Foundation), the traditional homogeneous model or equivalent load input mode is not suitable, which may bring great error. By introducing the changes of coefficients and phases of reflection and transmission of seismic waves at the interface between layers, an improved method of equivalent load input mode of traditional viscous-spring artificial boundary model is proposed. This new wave model can simulate the propagation law of seismic wave in layered site more accurately, which is available for the seismic performance of engineering structure under the condition of large and complex layered site. At last, the simplified homogeneous model, the equivalent load input method and the improved layered model input method are used to study the seismic response of the engineering example. It is shown that the results calculated by the three methods are different, which shows that the homogeneous foundation model and the conventional equivalent load input method of seismic wave cannot simulate the seismic force accurately, whereas the improved wave input model can better reflect the characteristic of traveling wave in layered sites.

*Keywords:* Earthquake Resistance of Engineering Structures; Layered Foundation; Time Domain Analysis Method; Seismic Wave Propagation; Improvement of Input Mode.

## 1. Introduction

Complex layered sites are often encountered in the construction process of various large-scale civil, water conservancy and transportation projects. Although the effects of layered sites on the structural dynamic response have been acknowledged, there is no comprehensive understanding and design experience of it due to the complexities. Consequently, how to evaluate the dynamic response characteristics, seismic stability and seismic measures of the interaction between superstructure and soil has become a difficult problem for the builders, and sometimes even directly affects the construction of the project. This paper is devoted to the analysis of structural dynamic response in layered sites.

It has been acknowledged that the dynamic soil-structure interaction in the analysis of seismic response should be considered. Various numerical methods are developed to simulate the seismic response, and they can be inducted as global artificial boundary and local artificial boundary theory [1]. The global artificial boundary theory, typically

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