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Soil Dynamics and Earthquake Engineering

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**Earthquake ground motion predictive equations for Garwal Himalaya, India**

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**ARTICLE INFO**

**ABSTRACT**

Soil dynamics and earthquake engineering is a multidisciplinary subject which involves the study of the interaction between the ground motion and the structure. This paper presents a study on the ground motion predictive equations for Garwal Himalaya, India. The study is based on the analysis of the recorded ground motion data from the Garwal Himalaya region. The study shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region. The study also shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region.

**1. Introduction**

The importance of earthquake ground motion predictive equations for Garwal Himalaya, India is highlighted in this paper. The study shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region. The study also shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region.

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**Seismic Wave Amplification: Basin Geometry vs Soil Layering**

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**Abstract**

The importance of seismic wave amplification is highlighted in this paper. The study shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region. The study also shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region.

**1. Analysis of data**

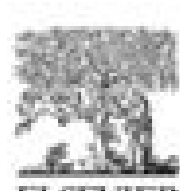
The study shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region. The study also shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region.

**2. The study area**

The study area is located in the Garwal Himalaya region. The study shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region. The study also shows that the ground motion predictive equations for Garwal Himalaya, India are similar to the ground motion predictive equations for the Garwal Himalaya region.



Fig. 1. Map of the study area in the Garwal Himalaya region.



# Free vibration of soils during large earthquakes

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### Abstract

Free vibration of soils happens frequently during some large earthquakes, perhaps seeming like a paradox. This happens because the energy released from seismic sources in some cases is not stationary in time, allowing relaxation intervals in between without important seismic wave arrivals in which free soil vibration happens. Two techniques to estimate the natural period of the free vibration from accelerograms are presented: autocorrelograms and Fourier spectra. Both techniques sometimes allow measuring higher mode frequencies of the soil for the three first modes as well as modal damping. Free vibration modal periods satisfy the classic 1D equation  $S$ -wave theory. The presence of free vibrations corresponds to shear wave soil energy radiation episodes rather than to energy amplification of incoming stationary seismic shear waves suggested by the dynamic soil amplification. These results explain the discrepancies observed between the theoretical soil dynamic amplification and the accelerographic measurement. Observation of free vibration of soils is not always possible, it depends on the duration of the time windows without important seismic wave arrivals compared to the natural period and damping of the soil.

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**Keywords:** Soil free vibration; Earthquake; Accelerogram; Autocorrelogram; Fourier spectra; Soil amplification

### Contents

1. Introduction	1
2. Autocorrelograms of earthquake accelerograms	2
3. Theoretical functions for autocorrelograms	2
4. Free vibration of soils in large earthquake accelerograms estimated from autocorrelograms	5
5. Soil damping	6
6. Soil fundamental period estimation using Fourier spectra and comparison with the autocorrelogram technique	7
7. Soil higher modes	8
8. Soil degradation in free vibrations from large earthquakes	9
9. Influence of soil free vibrations on soil dynamic amplification during large earthquakes	10
10. Conclusions	14
Acknowledgement	15
References	15

### 1. Introduction

Present seismic design practices, which incorporate information from strong motion accelerograms, very seldom reconcile the differences between accelerographic measurements and theoretical predictions. One factor

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Seismic Stability of the Nailed Slopes

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