Reliability assessment of dynamic soil properties

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Abstract

Dynamic soil properties are very important topic in geotechnical earthquake engineering due to associated with dynamic loading. Probabilistic analysis of dynamic soil properties is as effective tools to evaluate uncertainty of soil parameters. In this paper, Monte Carlo Simulation (MCS) is used for reliability assessment of dynamic soil properties. For this purpose, a famous model is selected for predicting normalized shear modulus reduction and damping ratio curves. The selected stochastic parameters are internal friction angle, dry and saturated unit weight of soil which is modeled using normal probability distribution functions. To assess the reliability of dynamic soil parameters a computer model is developed for generating input parameter uncertainties. The results show that the shear modulus and damping ratio have more uncertainty for middle range of shear strain. The sensitivity analysis's results show that saturated unit weight is the most effective parameter in shear modulus and damping ratio.

Key words: Damping ratio, Shear modulus, Monte Carlo Simulation, Reliability assessment

1. Introduction

The response of soils to cyclic loading is controlled mostly by the dynamical properties of the soil. [1] There are several types of geotechnical earthquake engineering problems associated with dynamic loading, some examples include: wave propagation, machine vibrations, seismic loading, liquefaction and cyclic transient loading, etc. The dynamical properties associated with dynamic loading are shear wave velocity (Vs), shear modulus (G), damping ratio (D), and Poisson's ratio (n) that shear modulus and damping ratio are the most effective properties. [2] The analysis of the geotechnical earthquake engineering problems in civil engineering requires characterization of dynamic soil properties using