



Seismic design of earth-retaining by artificial neural network

Ali Heidari¹, Mahvash Khakbaz²

1- Assistant professor, university of Shahrekord, Shahrekord, Iran

2- Bs student, university of Shahrekord, Shahrekord, Iran

aliheidari1@yahoo.com

Abstract

In this paper the seismic earth pressures is calculated by artificial neural network (ANN). The most commonly used methods to design the retaining wall under seismic conditions are the force equilibrium based pseudo-static analysis, pseudo-dynamic analysis and displacement based sliding block methods. In the design of these retaining structures, knowledge of earth pressures under both active and passive conditions should be cleared to compute the earth forces and their point of applications. In this paper, the force based analysis method is used to compute the active and passive earth pressures under seismic conditions for retaining wall to the earthquake hazard. Then the ANN is created and the seismic earth pressures are evaluated at any conditions. A significant benefit of the ANN is its ability to learn relationships between variables with repeated exposure to those variables. Therefore, instead of deriving an analytical relationship from mathematical formulations or experimental results, the ANN learns the relationship through an adaptive training process. In this method, the time and cost of analysis is reduced substantially.

Keywords: Seismic design, force based analysis, active and passive pressure, earth-retaining wall, artificial neural network.

1. INTRODUCTION

Earthquake-resistant design of earth retaining wall like retaining walls is very important problems to minimize the devastating effect of earthquake hazards. The designs of retaining walls, earth dam, abutments, foundations, etc. are very important problems related to the geotechnical engineering. To minimize the devastating effect of earthquake on retaining wall, computation of earth pressures and the point of applications carry attention of the researchers. The most commonly used methods to design the retaining wall under seismic conditions are the force equilibrium based pseudo-static analysis [1-3], pseudo-dynamic analysis [4] and displacement based sliding block methods [5-6]. In the design of this retaining wall, knowledge of earth pressures under both active and passive conditions should be cleared to compute the earth forces and their point of applications. This paper reviews the force based analysis method to compute the active and passive earth pressures under seismic conditions for retaining wall. Then the ANN is used to approximate the seismic earth pressures at any conditions. A significant benefit of the ANN is its ability to learn relationships between variables with repeated exposure to those variables. Therefore, instead of deriving an analytical relationship from mathematical formulations, the ANN learns the relationship through an adaptive training process. In this method, the time and cost of analysis is reduced substantially.

2. SEISMIC EARTH PRESSURES ON RETAINING WALL

In the design of retaining wall, the earth pressure (active, passive or at-rest, depending on the wall movement) has to earth pressures be computed properly. Broadly, force-based and displacement based analysis are used to compute these seismic. In this section force-based analysis is explained.

2.1. FORCE-BASED ANALYSIS

The seismic stability of earth-retaining wall is usually analysed by the pseudo-static approach in which the effects of earthquake forces are expressed by constant horizontal and vertical accelerations attached to the inertia. The common form of pseudo-static analyses considers the effects of earthquake shaking by pseudo-static accelerations that produce inertial forces, F_h and F_v , which act through the centred of the failure mass in the horizontal and vertical directions respectively. The magnitudes of the pseudo-static forces are,

$$F_h = \frac{a_h W}{g} = k_h W \quad (1)$$