2nd. National Conference on Civil Engineering, Architecture and Urban Planning of Islamic Countries
Tabriz University
2019

Automatic Damage Detection in Concrete Gravity Dams Using Vibration Signal Time-Frequency Features and the Support Vector Classifier

Sajad Esmaielzadeh[1], Hassan Ahmadi[2*] and Seyed Abbas Hosseini[3]

1. Ph.D. Student, Department of Civil Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran[1].
2. Assistant Professor, Department of Civil Engineering, Roodehen Branch, Islamic Azad University, Tehran, Iran.[۲]
3. Assistant Professor, Department of Civil Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran.[۳]

Abstract

In dam engineering, damage detection in concrete gravity dams (CGDS) is a practical problem. Dam destruction can have severe financial consequences and may even cause casualties. Therefore, damage detection in advance is absolutely crucial. The main objective of this study is the automatic detection of health or destruction of concrete gravity dams after applying vibration to them. To be more precise, %0 of destruction is categorized as normal and any percentage of destruction is regarded as damaged. In this regard, a well-known CGD, namely the Pine Flat Dam, has been chosen for the Finite Element modeling. The damage will be induced in the dam neck by elasticity modulus reduction by %40 and %80. This article has also used the processing of signal of the structure vibration in time domains with the help of classical linear and statistical features, time-frequency domain features with recourse to the wavelet method, extraction of statistical features in different levels and non-linear features, such as Shannon entropy. The most suitable features will be chosen after extracting them by the T-test. In the end, the support vector machines (SVM), linear discrimination analysis (LDA) and multi-layer perceptron (MLP) are used to find the most accurate diagnosis.

Key words: Damage Detection, Concrete Gravity Dams, Signal Processing, Support Vector Machine, Multilayer Perceptron

1. Introduction

Damage in concrete gravity dams causes high costs. These faults are often due to lack of attention to the codes and regulations accurately in the phase of design, inattentiveness in observing construction principles at the time of execution, the age of the dam or incorrect

[1] E-mail address: sajad_59es@yahoo.com, ORCID 0000000236266594
[2]*corresponding author, E-mail address: hgahmadi@riau.ac.ir, ORCID 0000000274690425
[3] E-mail address: abbas_hoseyni@srbiau.ac.ir, ORCID 0000000188503543