

A STUDY ON SOME DAMAGE ASSESSMENT METHODS BASED ON THE DYNAMIC CHARACTERISTIC CHANGES

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Keywords: Damage Assessment, Frequency Changes, Final Softening, Park-Ang, Pearson Correlation

ABSTRACT

In recent years many researchers have studied on the damage assessment based on dynamic characteristics. Alongside these researches, a lot of damage indices were proposed by researchers to locate and quantify the damage of the structures or to rank their vulnerability relative to each other. The variation of frequency and Softening indice are two methods to assess the damage based on dynamic characteristics. This paper studies on the performance of the frequency changes and Softening indices to assess the damage. In the paper three RC frames are modeled and nonlinear dynamic analyses are done. To identify the performance of the methods, the damage intensities which are measured by frequency changes and Softening indice, are compared to the damage intensities measured by Park-Ang indice. Park-Ang indice is one of the most widely used damage indices. Park-Ang is not based on the dynamic characteristics, but it can be a reliable indice to compare the results. The results show that in all the frames there are very strong correlations between frequency changes or Softening indice with Park-Ang. So it can be concluded that both of the methods are acceptable. Although the correlations between frequency changes and Park-Ang are a little more than the coefficients between Softening indice and Park-Ang, but the difference is negligible. The difference may be for inaccurate calculations of the final periods.

INTRODUCTION

Damage indices can provide information of damage intensity. In recent decades many researchers have proposed different damage indices to assess the damage of structures based on dynamic characteristics. The variation of frequency is one of the methods to assess the damage of the structures. Another method to assess the damage based on dynamic characteristics is Softening indice (DiPasquale and Cakmak., 1987), (DiPasquale and Cakmak., 1989), (DiPasquale et al., 1990). The final softening is based on fundamental period of the structure.

This paper studies on the performance of these methods. In this regard, flexural reinforced concrete frames are modeled and analyzed by nonlinear dynamic analysis under 124 records of far-field. The damage of the frames are measured by frequency changes and Softening indice. To compare the results, Park-Ang indice (Park and Ang., 1985). Park-Ang incorporates deformation and hysteretic energy absorption. It is not based on the dynamic characteristics, but it can be a reliable indice to compare the results.

To compare the results of dynamic characteristic changes with Park-Ang indice, Pearson correlation coefficient is used (Spiegel, 1992). Pearson correlation coefficient is used to evaluate the strength of the linear inter-relationship between two sets of data. Correlations between dynamic characteristic changes and Park-Ang indice shows the performance of the damage indices based on dynamic characteristic changes.