

Health Monitoring and Diagnosis of Irregular Buildings from Earthquake Response Records

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Abstract

In this paper, an analytical formula of damage index was developed to evaluate the damage degree for each story of a torsionally-coupled (TC) building, called SDITC, in both lateral directions. The SDITC can be easily calculated once the modal parameters of a building are obtained through system identification techniques from its response measurements before and after a potentially damaged earthquake event. The SDITC is defined as the reduction ratio of lateral story stiffness with and without damage and ranges from 0 (undamaged) to 1.0 (collapsed). It is found that only three sets of modal parameters are required to assess the degree of damage between measured floors. The damage region in measured floor can also be identified through tracking the moving direction of story rigidity centers. The SDITC was verified by numerical simulations, the ASCE benchmark model data analysis and also applied to evaluate the damage of the Taitung Fire Department building which is a four-story reinforced concrete building experienced severe damage during the 2006 Taitung Beinan Earthquake ($M=6.2$). The results agree fairly well with the field inspection to show the applicability of the proposed damage assessment technique.

Keyword: Story Damage Index; Torsionally-Coupled Building; System Identification; Earthquake Records.