STIFFNESS MATRIX OF SHEAR-TYPE BUILDINGS EXTRACTED FROM OUTPUT-ONLY DATA

Omid BAHAR
Assistant Professor, International Institute of Earthquake Engineering and Seismology (IIEES), Tehran, Iran
omidbahar@iiees.ac.ir

Masoud DARYOUSHI
Msc Graduate, International Institute of Earthquake Engineering and Seismology (IIEES), Tehran, Iran
m.daruoshi@iiees.ac.ir

Keyword: System Identification, Stiffness Matrix, Stochastic Subspace Identification, SSI

ABSTRACT

Direct extracting matrices of a building is of major interest of a practical engineers. In this paper a method based on the stochastich subspace state-space identification has been proposed to identify stiffness matrix of structures.Only the output data is used. Once the state matrix of a system is identified by using of a similarity transformation it transforms from discrete time general form to the continuous time classical form of mass-spring-damper systems. Then, with known mass matrix the stiffness and damping matrices are simply in hand by multiplying each corresponding block by mass matrix.

The proposed method is applied on a three-story two-dimansional shear frame. Once a model has been identified, a seismic assessment under Tabas earthquake excitation are examined and their responses are compared with the concern original model responses. The results show that this method is capable to be an appropriate tool for extracting main matrices of structures.

INTRODUCTION

The practical evaluation methods for evaluating dynamic systems like as vibrating structures has been subjected of intense interest in the last decades. Among these methods there are those based on the analysis of structural dynamic response measurements to identify a proper mathematical model corresponding to the state of structure so call system identification methods. So many studies has been conducted in nondestructive evaluation (NDE), active control of systems and structural health monitoring (SHM) relying on these methods. Active control has four key steps: (1) modelling, (2) system identification, (3) design of contollers and observers, and (4) verification. System identification methods as common step of all active control processes play a crucial role(Juang, 1994). Almost in structural health monitoring system identification has undeniable role. SHM aims to give, at every moment during the life of a structure, a diagnosis of the “state” of the constituent materials, of the different parts, and of the full assembly of these parts constituting the structure as a whole. The state of the structure must remain in the domain specified in the design, although this can be altered by normal aging due to usage, by the action of the environment, and by accidental events. Thanks to the time-dimension of monitoring, which makes it possible to consider the full history database of the structure, and with the help of usage monitoring, it can also provide a prognosis evolution of damage, residual life ,etc. (Balageas, et all, 2010). There are many description of SHM in literature, but in all of them system identification has significant place. Structural damage detection through SHM is indebted to system identification development.