A SEMI ACTIVE CONTROL STRATEGY FORSEISMIC TORSIONALLY COUPLEDBUILDING STRUCTURES

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ABSTRACT

This paper addresses the effects of different semi-active control strategies on seismic responses of one-story, asymmetric-plan systems. The Magneto-Rheological (MR) dampers have been used as a semi-active control device in numerous researches both for symmetric and asymmetric buildings due to their attractive characteristics. However, one can show that the level of reduction in seismic torsional responses of asymmetric buildings is strongly affected by the plan asymmetric parameters of the building. To examine the effect of asymmetry on the dynamic behavior of a controlled typical structure, a parametric study is performed using a mathematical model of a one-story building with an asymmetric stiffness distribution in one direction. The model is subjected to a uniaxial lateral disturbance, exciting both lateral and torsional motions. Due to the highly nonlinear dynamic behavior of MR dampers, existing uncertainty of seismic excitation and also torsional behavior of the systems, development of a robustness control algorithm is found as a significant challenge. Therefore application of optimal strategy to create an admissible control algorithm and attain the desired level of performance is also investigated in this study. In order to evaluate the effectiveness of the proposed methods, the performances of semi-active controllers are compared with some other control algorithms in a numerical example.

INTRODUCTION

It is well known that real responses of plane-asymmetric buildings with irregular mass or stiffness distributions can be affected by coupling of translational and rotational vibrations. This type of structures is likely to suffer more severe displacement demands at the corner elements under sever ground motions. Due to some architectural issues, employing traditional approaches to control seismic responses of these structures such as altering the stiffness and/or mass re-distribution is not usually practical choice. Structural control strategies represent relatively new and smart approaches to improve the performance of such systems(Yoshida and Dyke, 2005). Accordingly, supplemental damping devices have attracted growing worldwide interest as an innovative approach to protect structures against natural extreme events by enhancing the structural energy dissipation capacity. Depending on the level of energy dissipation required and the sensitivity related to the band control, a control system can be broadly categorized into various