A Robust Tendon Control Scheme for a Class of Cable–Stayed Structures

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ABSTRACT

A FEM model of pedestrian cable–stayed bridge is obtained. This model belongs to a class of cable–stayed structures for which an active vibration control scheme has been previously proposed, see (Rodellar et al. 2002). In this paper we present simulation results of the dynamics of the FEM model in the presence of seismic loads, using the control scheme proposed in the above reference.

1. INTRODUCTION

In this paper we deal with the active control of a model of cable-stayed bridges, which is mathematically described by a finite element model that includes the presence of uncertainties and seismic excitation. The control action is supplied by using a subset of the stay cables as active tendons. The dynamic model of the bridge is decomposed into two coupled subsystems, one of them including the degrees of freedom that are directly influenced by the active tendons, and the other describing the dynamics of the rest of degrees of freedom. A linear control law is proposed to drive the active tendons via feedback of the states of these degrees of freedom only. The control law uses restricted information on the bridge model.

2. FEM MODEL OF PEDESTRIAN CABLE–STAYED BRIDGE

2.1 Nominal FEM model

As a bridge prototype model, we consider a pedestrian cable-stayed bridge as the one illustrated in Figure 1. It is a one dimensional deck segment that is supported at the two ends, with a tower. 10 stay cables are attached to the tower and to the deck at specific locations. The bridge is excited by the vertical component of a seismic ground acceleration which enters simultaneously at both end supports. The control strategy