



Control of wind-induced vibration by combined tuned damper for super tall buildings

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Abstract

The wind-induced vibrations of super tall buildings become excessive due to strong wind loads, super building height and high flexibility. Tuned mass dampers (TMD) and tuned liquid column dampers (TLCD) have been widely used to control the vibration for super tall buildings for decades. As an economical vibration control option, the fire protection water tanks installed in super tall buildings are commonly utilized as TLCD to control the structural vibrations. There are however many cases that the TLCD system alone can hardly meet the human comfort criteria due to the storage limit of water tank, and additional TMD system can be installed to further reduce the structural vibration. The wind-induced vibration mitigation effects of super tall buildings equipped with both tuned mass dampers and tuned liquid dampers (CTD, combined tuned damper) are investigated in this study. To assess the effectiveness of the CTD system, a comparison study is conducted amongst the TLCD, TMD and CTD systems installed in a real super tall building project. The results show that the CTD system is cost-effective and has sound vibration mitigation capacity. Considering both the economical advantage of the TLCD system and the high efficiency of the TMD system, the CTD system is a competitive option for wind-induced vibration control of super tall buildings.

Keywords: Tuned liquid column damper, tuned mass damper, super tall buildings, wind-induced responses, structural response control

1 Introduction

Because the natural period of super tall buildings is close to the predominant period of wind load, the wind-induced vibration, especially buffeting caused by the fluctuating wind load, causes fatigue damage of the structure and moreover, it will also cause discomfort of occupants [1]. In order to improve the performance of human comfort of super tall buildings, the real buildings

often need to install vibration control device, commonly including tuned mass damper (TMD) and tuned liquid damper (TLCD) [2-5]. There are no doubt some limitations of this approach that traditional building cases mostly installed a single-type damper, for example, the case installing a simple TMD usually need large mass, more space and high cost and the case installing a simple TLCD is mostly with additional water tank except of the structure-needed fire protection water tanks.