**Study on Active and Semi-active Vibration Control of Buildings**

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This study proposes two types of new vibration control methods. One, using active response control, enhances the habitability of high-rise buildings in strong winds, while the other uses semi-active response control to improve building safety and functionality during earthquake excitations.

The principal attainments of this work are summarized as follows:

1. A variable-gain feedback control technique is devised that extends the applicable range of active mass damper systems significantly from weaker to stronger wind excitations.

2. An optimal displacement feedback control law is derived based on analytical investigations in which the linear quadratic optimal control problem is solved for a single-degree-of-freedom structure with an active tuned mass damper. The results also provide a suitable basis for further analytical study.

3. New vibration control methods using semi-active hydraulic dampers are developed; one counteracts excessive displacement response of a base-isolation system against long period ground motions; the other uses sliding mode control to reduce the acceleration response of base-isolated buildings.

The proposed control methods have been applied to more than six super high-rise buildings and their performance has been clarified through wind and earthquake observations. As a result, the new active and semi-active vibration control methods can be considered fully established.