Master of Science Project

Active Control of Structural Behaviour

Many advanced structures have some kind of active control. A famous example is the tuned mass damper at the top floor of many high-rise buildings to reduce wind motion. Nowadays, the equipment for such a system is no longer very expensive or high-tech. Structural design offices regularly consider application of an active control system during construction or after completion. Examples are active struts (Dutch: stempels) to obtain zero displacement during renovation, adaptive BLOB architecture that responds to visitors and damping of vortex-induced vibrations of a bridge. A basic active control system consists of 1) an actuator 2) a sensor and 3) a feed back algorithm. Each of these parts are essential for a successful system. The feed back system can be very simple (if too small than on else out) or very complicated (neural networks).

Other engineering fields have much experience in active control. Examples are the electronics of a radio which includes many feed back loops, fighter jets fly stable only due to actively controlled flaps and robots at an assembly line can pick up things that are not exactly where they are supposed to be.

The challenges of this project include

1) Study active control systems and determine of each system whether it is suitable for structural engineering application.

2) Consider the risks involved in active control of essential structural behaviour.

3) Acquire the knowledge and software to design an active control system.

4) Design, build and test an active control system for a structural engineering application

Figure: Taipei 101, Taiwan, actively controlled for wind motions

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