Active Tendon Control of Cable Structures at ULB: Theory and Experiments

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Abstract:

The paper describes the research work conducted at ULB over the past 10 years on the tendon control of cable structures, with applications to cable-stayed bridges and large space structures. The control strategy uses an active tendon which combines a collocated sensor/actuator pair consisting of a force sensor and a displacement actuator. The first part of the paper develops the theory; it is shown that the control strategy has the following advantages: (1) It does not rely on a model of the structure, and is very robust; (2) The performances are very easy to predict from the knowledge of the natural frequencies of the structure with the active cables attached (open-loop poles) and with the active cables removed (open-loop zeros). The second part compares the theoretical results with experimental ones obtained on laboratory scale models representative of a space truss and a cable-stayed bridge; the correlation between theory and experiment is excellent. Finally, the paper describes a large scale demonstrator of a cable-stayed bridge built in the framework of the EU-funded project ACE.