Contrôle de haute précision des grands instruments dédiés à la physique expérimentale

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Started during the 20th century, the tendency to construct large facilities for experimental physics, like particle colliders and gravitational wave detectors, is confirmed this century by launching numerous new projects, with always more stringent requirements on the performances, in order to push continuously the limits of physics knowledge: increase the diameter of a telescope to increase the resolving power; increase the length of a particle collider to increase the energy of the particles; increase the length of a gravitational wave interferometer to improve its sensitivity…

The complexity of building opto-mechatronic systems larger and larger is also magnified by several new difficulties (like control/structure interaction, thermo-mechanical effects, synchrotron radiations), which engender increasing research efforts and budgets. Each new instrument has specific objectives and specific design constraints, which require developing dedicated engineering solutions. However, some instruments can also share very similar and generic challenges. An emblematic example is the stabilization of sensitive parts, requiring an extremely good isolation from ground vibration.

This talk will start with an overview of the challenges in vibration control for some instruments dedicated to experimental physics, and will continue with the presentation of recent efforts to control future particle colliders and gravitational wave detectors. Some similarities between the problems to control these instruments will be pointed out, showing that a transversal view can facilitate technology transfers.