

11-14 November 2025
Opatija, Croatia



Contribution ID: 12

Type: **talk**

Multi-scale optimal control for Einstein Telescope active seismic isolation

We present a multi-scale optimal control framework for active seismic isolation in the Einstein Telescope, a third-generation gravitational-wave observatory. Our approach jointly optimizes feedback and blending filters in a cross-coupled opto-mechanical system using a unified cost function based on the “acausal optimum,” which quantifies sensor signal-to-noise ratios across frequencies. This method enables efficient re-optimization under varying sensor configurations and environmental conditions. We apply the framework to two candidate sensing systems: OmniSens—a six-degree-of-freedom inertial isolation system—and BRS-T360, which combines Beam Rotation Sensor (BRS) as an inertial tilt sensor with T360 as a horizontal seismometer. We demonstrate superior low-frequency isolation with OmniSens, reducing platform motion by up to two orders of magnitude near the microseism. The framework allows for ready optimization and projection of sensor noise to metrics relevant to the performance of the instrument, aiding the design of the Einstein Telescope.

Author: SAFFARIEH, Pooya

Presenter: SAFFARIEH, Pooya

Session Classification: Instrument Science (ISB)

Track Classification: ISB: Active Noise Mitigation