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Research and development of LVDT positon sensor and actuator for the seismic attenuation of ETpathfinder experiemnt

The precise monitoring and active damping of seismic noise are paramount in gravitational wave (GW) detectors. This system utilizes linear variable differential transformer (LVDT) position sensors coupled with voice coil actuators to monitor and control vibrations at the required levels. Our research highlights the design, simulation, production, and characterization of these LVDT sensors and actuators. A comprehensive simulation framework, using pyFEMM, has been developed to model and test various LVDT designs, including novel configurations. Additionally, we have established a dedicated experimental setup, and production platform, along with a standard operating procedure (SOP) and a detailed checklist of procedures. Significant advancements have been made in coil production, with comprehensive tests evaluating coil sensitivity, actuation forces, and noise analysis. These efforts provide insights into the efficiency of the LVDTs, including their linear and non-linear movement ranges, ensuring the precise monitoring and active damping of seismic noise critical to gravitational wave detectors. This talk also highlights the group's initial work on novel LVDT designs and the latest advancements in our work.

Primary author: KUKKADAPU, Kumar Akhil

Presenter: KUKKADAPU, Kumar Akhil

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