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Sensing and actuation system for the University of Florida Torsion Pendulum for LISA ANDREW CHILTON, RYAN SHELLEY, TAIWO OLATUNDE, GIACOMO CIANI, JOHN CONKLIN, GUIDO MUELLER, University of Florida — Space-based gravitational wave detectors like LISA are a necessity for understanding the low-frequency portion of the gravitational universe. They use test masses (TMs) which are separated by Gm and are in free fall inside their respective spacecraft. Their relative distance is monitored with laser interferometry at the pm/rtHz level in the LISA band, ranging from 0.1 to 100 mHz. Each TM is enclosed in a housing that provides isolation, capacitive sensing, and electrostatic actuation capabilities. The electronics must both be sensitive at the 1 nm/rtHz level and not induce residual acceleration noise above the requirement for LISA Pathfinder ($3*10^{-15}$ m/sec^{2}Hz$^{1/2}$ at 3 mHz). Testing and developing this technology is one of the roles of the University of Florida Torsion Pendulum, the only US testbed for LISA-like gravitational reference sensor technology. Our implementation of the sensing system functions by biasing our hollow LISA-like TMs with a 100 kHz sine wave and coupling a pair surrounding electrodes as capacitors to a pair of preamps and a differential amplifier; all other processing is done digitally. Here we report on the design of, implementation of, and preliminary results from the UF Torsion Pendulum.

Andrew Chilton
University of Florida

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