

The latest development in ALFRA, the UWA low-frequency rotational accelerometer

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Ground rotation sensors at low-frequency have a vital role in improving seismic isolation systems in advanced and 3G gravitational wave detectors. It was found that using seismometers as the sole source of ground motion measurement results in undistinguishable motion detection between horizontal and tilt motion, especially below 100 mHz. Therefore, pure angular motion measurement is necessary to separate tilt and translation to be applied as feedback in active isolation control. ALFRA is a low-frequency rotational accelerometer developed at the University of Western Australia (UWA) to detect ground tilt motion. It is a compact, inertial reference style rotation sensor that can be mounted in three orientations to detect ground tilt around a different axis of interest. A preliminary study of a prototype showed that ALFRA can achieve high readout sensitivity of few nrad/ $\sqrt{\text{Hz}}$ above 20 mHz and 0.1 nrad/ $\sqrt{\text{Hz}}$ above 50 mHz in measuring ground tilt. In this work, we will present our latest design for ALFRA and highlight several improvements that will be added to our previous design to enhance several aspects of the sensor and increase its sensitivity, usability, and convenience of adjustment.