S012-0003 - Testing of a Six Degree of Freedom Sensor for Seismic Building Monitoring.

📅 Tuesday, 8 December 2020

🕐 13:00 - 05:59

Live Chat with Presenter Ended 8 December 16:00

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Abstract

Rotational seismology is an emerging area of research with many important applications, such as infrastructure monitoring. Seismometers have already been used to measure building motion and inter-story drift to estimate a buildings stability, but this is only half the story, it has long been known that buildings can experience substantial rotational motion which can be very damaging. A six degree of freedom (6DoF) sensor provides co-located measurements of building acceleration and rotation, giving a full description of the building motion without the need for an external point of reference and vastly improving assessments of the building's stability.

In this work we investigate one such sensor, the IMU50 six degree of freedom sensor (from iXblue, France). This sensor uses a Micro-Electric Mechanical System (MEMS) accelerometer to measure translational motion and a fiber optic gyroscope for the rotation components. The compact size of the sensor recommends it for building health monitoring as it is relatively unobtrusive, however, to be useful in monitoring the sensitivity of the sensor must be established.

Here we estimate the self-noise of the sensors using the amplitude range, power spectral density, and Allan deviation. The sensors were calibrated using two methods, a step table and comparison with earth's rotation rate. To characterize the sensors performance and their applicability to building monitoring the self-noise levels were compared with amplitude levels of building motions obtained from 6DoF measurements in St. Peter's cathedral in Cologne, Germany and in the Giotto bell tower in Florence, Italy. Additionally, building shaking amplitudes during earthquakes reported in literature were taken for comparison with sensor performance.

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