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BSSA Special Issue on Rotational Seismology

A special May issue of the Bulletin of the Seismological Society of America (BSSA) focuses on the emerging field of rotational seismology and its applications to engineering. The special issue will feature seismological research on all aspects of rotational ground motions (including theory, instrumentation, observation, and interpretation) and on rotations in structural response.

Rotational seismology is of interest to a wide range of disciplines, including various branches of seismology, earthquake engineering, and geodesy, as well as to physicists using Earth-based observatories for detecting gravitational waves generated by astronomical sources as predicted by Einstein in 1916.

Seismology and earthquake engineering have been based on the observation and modeling of translational ground and structural motions. Although rotational effects from earthquakes have been observed for centuries, rotational ground motion has been ignored due to a widespread belief that rotation is insignificant and practical difficulties in measuring it. Theoretical work in modern rotational seismology began in the 1970s, and attempts to deduce rotational motion from accelerometer arrays began in the 1980s. However, modern direct measurements of rotational ground motions began only about a decade ago when affordable angular sensors became sensitive enough (capable of measuring an angle of less than ten thousandth of a degree) to detect rotations from small earthquakes, while large ring laser gyros (intended for studying the Earth's rotation) became capable of detecting even smaller rotations from distant earthquakes.

Ring laser observations at Wettzell, Germany and at Piñon Flat, California demonstrated consistent measurements of rotational ground motions in the far field. The high cost of present high-precision ring laser gyros (costing $1 million or more) makes widespread deployment unlikely. Less expensive and/or less sensitive alternatives are now being pursued by five academic groups. At present, only Taiwan has a modest program to monitor both translational and rotational ground motions from regional earthquakes at several free-field sites, as well as two arrays equipped with both accelerometers and rotational seismometers in a building and a nearby site.

Based on the developments described in the BSSA special issue, observation, analysis, and interpretations of both rotational and translational ground motions will soon play a significant role in seismology and earthquake engineering.

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