Instrument Correction for 6DOF Seismic Sensors

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ABSTRACT

Most seismometers and strong motion transducers deployed in seismic monitoring networks are (or are equivalent to) penduli, and are therefore sensitive to rotation of the support, besides the component of translation that is to be recorded. Consequently, pendulum transducers record a *mixture of translations and rotations*, which *cannot be separated unless rotations are also recorded at the same point*. Traditionally, the rotational components of earthquake ground motion and of the response of structures have not being recorded by seismic arrays. Direct measurements of rotation during earthquakes are rare but do exist, and there is a growing interest in the seismological and earthquake engineering communities to deploy more rotational sensors in the field, and record all six degrees-of-freedom (6 DOF) of seismic motion at a point.

The separation of "pure translations" from the recorded mixture of motions using data from 6 DOF sensors also requires a special instrument correction algorithm and software, which do not exist at present. This paper will present an algorithm for such a correction for a generic 6DOF sensor, being developed by the authors, and some tests using synthetic but realistic 6 DOF motions.

An important benefit of instrument correction for 6 DOF sensors is that it will *extend the limits of the useable information that can be obtained from the high dynamic range and high resolution translational sensors*, e.g. information on complex motions and residual deformation of the ground or of structures, associated with faulting or with nonlinear response. Permanent displacement cannot be obtained reliably by double integration of recorded translational accelerations, unless the recorded motion is "corrected" for the contribution from rotations of the instrument support and transducer misalignment and cross-axis sensitivity.