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# of Complex Seismic Sources by Orthogonal Moment Tensor Fields

Complexity of seismic sources can be represented by space-time variations of stress gluts. We present a new representation theorem of seismic sources that exactly and uniquely decomposes any stress-glut density into a set of up to six orthogonal tensor fields of increasing degree (Juarez & Jordan, GJI-2018). The moment tensor fields are ordered by their first nonzero polynomial moments. The representation theorem generalizes the point-source approximation to a sum of multipoles that features the centroid moment tensor (CMT) as its 0th-degree term. We define the total scalar moment MT to be the integral of the scalar moment density, and we use the representation theorem to estimate moments for each degree. If the source is complex MT > M0, the Aki moment. We decompose seismic source models of earthquakes and explosions to illustrate how the higher-degree terms characterize the source complexities. We compute synthetic seismograms to illustrate the radiation patterns of the higher-degree fields and their frequency dependence. Our results indicate that the radiation from the higher-degree fields was large enough that it may be possible to estimate low-order multipoles directly from seismic data.

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