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3D Multisource Full-Waveform Inversion using Dynamic Quasi-Monte Carlo Phase Encoding

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Full-waveform inversion (FWI) is a powerful but expensive method for estimating a velocity model from seismic data. Its computational cost can be reduced by using a multisource method in which multiple sources are used simultaneously to compute the gradient and several common shot gathers (CSGs) are blended together into one super shot gather (SSG). Although multisource FWI using only one SSG has significantly high efficiency, our multisource FWI method uses multiple SSGs to compromise between quality and efficiency. The phase encoding strategy, i.e., a method for blending multiple CSGs into a SSG, used in this work is called a dynamic random phase encoding strategy–the polarity and location of simulataneous sources are randomly assigned and changed every iteration to reduce crosstalk noise in multisource FWI. In addition, a quasi-Monte Carlo method is used to assign the simultaneous source locations. Numerical results from the 3D SEG/EAGE overthrust model show that multisource FWI with dynamic QMC phase encoding is about two orders of magnitude faster than conventional FWI and provides a higher-quality velocity tomogram than multisource FWI using only one SSG.