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On Sampling Optimization Based on Mutual Coherency Criterion

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Abstract

Acquisition design plays a very significant role in seismic exploration and data processing. An optimized seismic acquisition design will require fewer resources and therefore, it can reduce the total cost of seismic exploration. Nevertheless, finding the optimal locations of sources and receivers in a seismic survey is a long-standing problem, which has received less attraction in last few decades. It has been well known that higher bandwidth seismic data can be recovered from random sampling of a fixed number of sensors than uniform or regular sampling. However, controlling the maximum gap between sensors and satisfying other logistic constrains (e.g., land obstacle, preferred surface topographic regions) are not possible to ensure in random sampling. Therefore, in this paper, we have proposed a continuous non-uniform sampling (CNUS) technique to determine the optimal locations of receivers for seismic survey design while satisfying the maximum gap and logistic constraints. The proposed sampling method adopts the concept from the field of compressive sensing (CS). Our main goal is to reduce the mutual coherency between sampling scheme and sparsifying transform. However, the design of optimal receiver pattern is a non-linear optimization problem and hence, we have implemented global optimization method to solve this problem. Numerical experiments on optimal sampling technique show good performance.

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