

A decentralized algorithm for acoustic localization using a distributed sensor network

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Abstract.

An acoustic source localization algorithm has been developed for use with large-scale sensor networks using a decentralized computing approach. This algorithm, based on a time delay of arrival (TDOA) method, uses information from the minimum number of sensors necessary for an exactly determined solution. Since the algorithm is designed to run on computational devices with limited memory and speed, the complexity of the computations has been intentionally limited. The sensor network consists of an array of battery-operated COTS Ethernet-ready embedded systems with an integrated microphone as a sensor. All solutions are calculated as distinct values, and the same TDOA method used for solution is applied for ranking the accuracy of an individual solution. Repeated for all combinations of sensor nodes, solutions with accuracy equivalent to complex array calculations are obtainable. Effects of sensor placement uncertainty and multipath propagation are quantified and analyzed, and a comparison to results obtained in the field with a large array with a centralized computing capability using a complex, memory intensive algorithm is included.