Using a linear array to estimate the velocity of underwater moving targets(PDF)

Title:
Using a linear array to estimate the velocity of underwater moving targets

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关键词: underwater velocity measurement; linear array; direction of arrival (DOA); deterministic maximum likelihood; signal phase matching

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摘要:
A new method uses a linear array that takes advantage of underwater physical sound fields to estimate the velocity of an underwater moving target. The mathematical model was established by considering the geometric relationship between the moving target installed with only two transducers to radiate sound of different frequencies and the linear array. In addition, deterministic maximum likelihood and signal phase matching algorithms were introduced to effectively find the directions of arrival (DOAs) of the sound sources of the two transducers installed on the target. Factors causing velocity measurement errors were considered. To track the target, a linear array with a compass, a pressure transducer, a signal conditioner and a digital recorder was configured. Relevant requirements for the array parameters were derived. The simulation showed that a 16-element array with an aperture of less than 1m can measure velocity with relative error of no more than 4% when including typical system errors. Anechoic pool and reservoir experiments confirmed these results.

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