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应用

利用波导不变量的水平线阵被动估距方法研究

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摘要：

波导不变量是描述海洋声场距离-频率干涉结构现象的一个重要特征参量，可用于改善水听器接收声场的纵向相关性。本文在讨论波导不变量改善水平线阵两个子阵波束输出信号相关性的基础上，利用波束形成和浅海声传播模型得到目标方位和波导不变量的估计后，提出了一种基于波导不变量的水平线阵被动估距方法。通过浅海环境下360米水平线阵的数值仿真和实际海试数据处理研究表明：这种距离估计方法在偏离正横方向一定角度的条件下，当波束输出信噪比达到6~9dB以上时，对30公里以内的声源距离估计精度在10%以内，但在正横方向附近存在一个约20度的估距盲区，此盲区的范围有望通过目标距离的减小、阵孔径的增大或处理频段的升高而缩小。

关键词： 波导不变量；水平线阵；被动估距

Research on passive range estimation with a horizontal line array using waveguide invariant

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Abstract:

The waveguide invariant，which describes the acoustic intensity interference pattern in ocean waveguide with a single scalar parameter, can be used to improve the longitudinal correlation of acoustical field. In this paper, after obtaining the estimation of bearing and waveguide invariant parameter, an approach to passive range estimation based on improvement of the correlation of two horizontal sub-array signal beam outputs using waveguide invariant is derived. By simulation analysis and the validation of the experimental array data at sea with a 360-meter horizontal line array in shallow water, we find that the range estimation error using the derived approach is less than 10% for the source whose range is within 30 kilometers when the SNR at the beamformer output is larger than 6~9dB. However，there is an estimated blind zone at angles near broadside that is about 20 degree for a horizontal array with 360-meter aperture, which can be reduced when the source range decreases， the array aperture increases or the signal frequency increases.

Keywords: waveguide invariant； horizontal line array；passive range estimation

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