电子与信息学报 2007 29 (10): 2305-2308 ISSN: 1009-5896 CN: 11-4494/TN

论文

基于匹配滤波和离散分数阶傅里叶变换的水下动目标LFM回波联合检测

陈 鹏[①②], 侯朝焕[①], 马晓川[①], 梁亦慧[③]

[①]中国科学院声学研究所 北京 100080;[②]中国科学院研究生院 北京 100039;[③]船舶系统工程部 北京 100036

收稿日期 2006-4-3 修回日期 2006-8-21 网络版发布日期 2008-1-3 接受日期

摘要
匹配滤波器是高斯白噪声背景下LFM回波的最优检测器，并且根据匹配滤波器输出的峰值位置可以获得目标距离的估计。有色混响噪声背景以及目标径向速度造成的回波和样本失配都将导致匹配滤波器检测性能和测距精度下降。结合匹配滤波的定位特性和分数阶傅里叶变换对LFM信号的聚焦特性，该文提出基于匹配滤波和离散分数阶傅里叶变换的联合检测方法。仿真结果表明联合检测方法性能优于单匹配滤波器，并且可以获得目标径向速度的近似估计。

关键词 混响 匹配滤波器 LFM 径向速度 FFT 离散分数阶傅里叶变换

分类号 TN911.7

The Joint Detection to Underwater Moving Target's LFM Echo Based on Matched Filter and Discrete Fractional Fourier Transform

Chen Peng[①②], Hou Chao-huan[①], Ma Xiao-chuan[①], Liang Yi-hui[③]

[①]Institute of Acoustics,Chinese Academy of Sciences, Beijing 100080, China;
[②]Graduate School of Chinese Academy of Sciences, Beijing 100039, China;[③]Ship Engineering Research Institute, Beijing 100036, China

Abstract
Matched filter is the optimal detector of LFM echo under the Gaussian white noise background, and the estimation of target range can be achieved according to the peak position of the matched filter's output. The colored reverberation background and the mismatch between echo and replica caused by target's radial velocity will both degrade the detection performance and the distance estimation precision. Combining the ranging property of matched filter and the focusing property of fractional Fourier transform to LFM signal, this paper proposes the joint detection method based on matched filter and discrete fractional Fourier transform. Simulation results show the joint detection method performs better than the pure matched filter, and the approximate estimation of target's radial velocity can be obtained by the joint detection method.

Key words Reverberation Matched filter LFM Radial velocity FFT Discrete FRactional Fourier Transform(DFRFT)

DOI:

通讯作者

作者个人主页 陈 鹏[①②]; 侯朝焕[①]; 马晓川[①]; 梁亦慧[③]