

论文

## 非合作水声低载噪比直接序列扩频信号的载频估计方法

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摘要

在非合作条件下, 该文针对水声直接序列二相调制扩频信号的载频估计, 提出了一种在载噪比较低和信号产生较大畸变情况下仍保持一定估计准确度的方法。分析了该类信号的功率谱特性, 利用其载频处的谱包络下凹特性, 提出功率谱包络局部极小值载频估计方法。论文采用重心法获得载频初值, 再通过初值附近的局部最小值搜索以获得载频的精确估计。该算法复杂度低, 低载噪比和信号失真情况下鲁棒性好, 具有一定的实用价值。采用蒙特卡洛方法进行了仿真验证与性能评估, 仿真结果与理论分析一致。海试结果也验证了该方法的可行性与实用性。

关键词 [水声信号处理](#) [直接序列扩频信号](#) [低载噪比](#) [载频估计](#) [非合作](#)

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## A Carrier Frequency Estimation Method of Non-cooperative Underwater Acoustic Direct-Sequence Spread-Spectrum Signal Under Low-CNR

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Abstract

A new method is proposed in this paper to accomplish the carrier frequency estimation of non-cooperative underwater acoustic DSSS-BPSK signal. The carrier frequency estimated using the method is accurate even under low-CNR and signal distortion conditions. A rough estimation of the carrier frequency is first made through gravity method. With the concave point characteristic of the signal power spectrum envelope at the carrier frequency, a more precise carrier frequency is then estimated by searching the local minimum of the power spectrum envelope in the frequency neighborhood of the rough estimation. Monte Carlo simulations of the method are in accord with theoretical analysis. Results of oceanic experimental data test also verify the effectiveness feasibility and practicality of the method for its low complexity and robustness under low-CNR and signal distortion conditions.

Key words [Underwater acoustic signal processing](#) [Direct Sequence Spread Spectrum \(DSSS\) signal](#) [Low Carrier Noise Ratio\(CNR\)](#) [Carrier frequency estimation](#) [Non-cooperative](#)

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