算法研究

联合STFT-迭代变权拟合的LFM信号参数估计方法

姚帅，方世良，王晓燕

东南大学水声信号处理教育部重点实验室

摘要：

针对现有线性调频(LFM)信号参数估计方法估计精度与估计速度难以兼得，以及对信号畸变敏感的难题，提出了一种联合Rife插值改进的短时傅里叶变换(STFT)-迭代变权最小二乘线性拟合(IRLSF)参数估计的方法。使用Rife插值改进的STFT较好地保持了LFM信号瞬时频率曲线的线性特征，迭代变权处理有效地抑制了估计得到的瞬时频率中出现异常值对参数估计精度的影响。该方法无需进行复杂的计算和参数搜索，实时性好。仿真分析表明，相对于常规最小二乘线性拟合(CLSF)方法信噪比下限降低了4dB。湖试结果验证了该方法的有效性和实用性。

关键词： 线性调频信号；短时傅里叶变换；Rife插值；迭代变权拟合

Parameter-Estimation of LFM Signal Based on Combined Short Time Fourier Transform and Iteratively Reweighted Fit

YAO Shuai, FANG Shi-Liang, WANG Xiao-Yan

Key Laboratory of Underwater Acoustic Signal Processing of Ministry of Education, Southeast University,Nan Jing

Abstract:

To solve the problems that the estimation accuracy and the speed of the existing Linear Frequency Modulation (LFM) signal parameters estimation methods are mutually exclusive and sensitive to signal distortion, a parameters estimation method based on combined improved Short Time Fourier Transform (STFT) with Rife interpolation and Iteratively Reweighted Least Squares Linear Fit (IRLSF) is proposed. The improved STFT with Rife interpolation which is used to extract the instantaneous frequency of LFM signal can keep the linear feature of the instantaneous frequency well and the iterative reweighted process which is used to fit the instantaneous frequency curve can reduce the impact of exceptional values on parameter estimation accuracy. With no need of complex calculation and parameters searching, this method has a good real-time performance. The results of Monte Carlo simulation experiment show that the low limit of Signal-to-Noise Ratio (SNR) is reduced 4dB comparing with the Conventional Least Squares Linear Fit (CLSF) method and the parameter estimation performance approaches to the Cramer-Rao Lower Bound (CRLB) at a high SNR. At last, the lake experimental results verify its validity and feasibility.

Keywords: Linear Frequency Modulation signal   Short Time Fourier Transform   Rife interpolation iteratively reweighted fit

通讯作者：

作者简介：

作者Email: yaoshuai@126.com

参考文献：

本刊中的类似文章

文章评论

反馈人		邮箱地址	
反馈标题		验证码	8758