

短文与研究通讯

线性调频信号分数阶频谱特征分析

徐会法, 刘锋

海军航空工程学院电子信息工程系, 烟台; 94362部队, 青岛

摘要:

线性调频信号是一种典型的非平稳信号, 广泛应用于雷达、声纳、通信等领域。分数阶Fourier变换是一种新兴的时频变换, 由于其独特的性质, 成为线性调频信号检测与参数估计的一种良好工具。尤其是, 作为一种线性变换, 分数阶Fourier变换在处理多分量线性调频信号时能够避免交叉项的干扰。但是, 多分量线性调频信号在分数阶Fourier域也存在相互影响的问题。为了分析该问题, 研究线性调频信号在分数阶Fourier域的频谱分布特征是非常必要的。本文根据分数阶Fourier变换的定义以及分数阶Fourier变换与时频分布的关系, 分析了线性调频信号在分数阶Fourier域的频谱分布特征, 以及线性调频信号的分数阶频谱分布与分数阶旋转角 α 的变化关系; 根据离散分数阶Fourier变换的实现算法, 讨论了线性调频信号在离散分数阶Fourier变换条件下的分数阶频谱的分布特征, 以及线性调频信号在分数阶Fourier域的能量谱的近似表达式。最后, 利用LFM信号的分数阶频谱的分布特征, 分析了多分量LFM信号中的信号尖峰偏移问题, 并给出信号尖峰发生偏移的条件。本文为定量分析分数阶Fourier域多分量线性调频信号之间的相互影响奠定了基础, 为改善分数阶Fourier变换对多分量线性调频信号的处理能力提供了参考。

关键词: 线性调频信号; 分数阶Fourier变换; 频谱特征

Spectrum Characteristic Analysis of Linear Frequency-Modulated Signals in the Fractional Fourier Domain

XU Hui-Fa, LIU Feng

Department of Electronic and Information Engineering, Naval Aeronautical Engineering Institute, Yantai
The 94362th Unit of PLA, Qingdao

Abstract:

Linear frequency-modulated signal is a kind of typical non-stationary signal and is used widely in the fields of radar, sonar, communications and so on. The fractional Fourier transform is a new kind of time-frequency transform and has become a good tool of the detection and parameter estimation of the linear frequency-modulated signal because of its unique properties. Especially, as a linear transform, the fractional Fourier transform can avoid the cross-terms interference in multi-component linear frequency-modulated signals processing. However, the multi-component linear frequency-modulated signals also have the problems of the mutual effects among the signals in the fractional Fourier domain. In order to solve the problems, it is very necessary to study the spectrum distribution characteristics of the linear frequency-modulated signal in the fractional Fourier domain. First, in this paper, based on the definition of the fractional Fourier transform and the relationship between the fractional Fourier transform and time-frequency distribution, the spectrum distribution characteristics of linear frequency-modulated signal is analyzed in the fractional Fourier domain, and the relationship between the spectrum distribution of linear frequency-modulated signal and the fractional rotation angle α is also analyzed. Second, based on the algorithm of digital computation of the fractional Fourier transform, the digital fractional spectrum distribution characteristics of the linear frequency-modulated signal are analyzed, and the approximate expression of the linear frequency-modulated signal's energy spectrum in the fractional Fourier transform is deduced. Finally, using the fractional spectrum distribution characteristics of the linear frequency-modulated signal, the peaks shifting of the multi-component linear frequency-modulated signals is studied in the fractional Fourier domain, and the reason and conditions of the peaks shifting are given. This paper establishes the foundation to analyze the quantitative relationship of mutual effects among multi-component linear frequency-modulated signals in the fractional Fourier domain, and it also offers an important reference to improve the ability of the fractional Fourier transform to process the multi-component linear frequency-modulated signals.

Keywords: Linear frequency-modulated signal fractional Fourier transform spectrum characteristic

收稿日期 2010-03-02 修回日期 2010-08-11 网络版发布日期 2010-12-25

DOI:

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(1133KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 线性调频信号; 分数阶Fourier变换; 频谱特征

本文作者相关文章

- ▶ 徐会法
- ▶ 刘锋

PubMed

- ▶ Article by Xu, H. F.
- ▶ Article by Liu, F.

基金项目:

通讯作者:

作者简介:

作者Email: radar4228@163.com

参考文献:

本刊中的类似文章

文章评论

反馈人	<input type="text"/>	邮箱地址	<input type="text"/>
反馈标题	<input type="text"/>	验证码	<input type="text" value="0403"/>

Copyright by 信号处理