综述

分数阶Fourier变换在动目标检测和识别中的应用：回顾和展望

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摘要：

作为Fourier变换的广义形式，分数阶Fourier变换(FRFT)能够展示出信号从时域到频域的所有变化特征，通过对时频平面的旋转，FRFT非常适合处理非平稳信号，克服了传统时频分析方法受交叉项干扰、分辨率低等缺点。动目标的雷达回波信号在一段短时间范围内，可用线性调频(LFM)信号作为其一阶近似，因此采用FRFT检测动目标具有很大的优越性。本文首先从FRFT的机理和特点出发，对基于FRFT的LFM信号检测和估计、最佳变换角确定方法等相关研究进行归纳与分析；然后，从高速微弱动目标检测、SAR成像和动目标检测、反辐射导弹检测、海洋动目标检测和雷达信号识别等方面重点介绍了FRFT理论在动目标检测和识别领域的应用和主要技术途径；最后，针对现有研究中存在的问题，阐述了有待于进一步研究的方向。

关键词： 动目标检测；目标识别；线性调频(LFM)信号；分数阶Fourier变换(FRFT)；变换角度；海杂波

Application of Fractional Fourier Transform in Moving Target Detection and Recognition: Development and Prospect

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Abstract:

As the generalized Fourier transform (FT), fractional Fourier transform (FRFT) can reveal the properties of time-varying signal in time and frequency domain. By rotating the time-frequency plane, FRFT is more suitable for non-stationary signal processing and can overcome disadvantages of the cross-term interference and low resolution using traditional time-frequency analysis methods. Linear frequency modulation (LFM) signal can be regarded as the first order approximation of radar echo from moving target and hence it has great superiority in the moving target detection based on FRFT. In this paper, detection and estimation of LFM signal, determination methods of the best transform angle, et al., are firstly reviewed with the principle and characteristic of FRFT. Then, applications of FRFT in moving target detection and recognition are introduced from the following aspects: high speed weak target detection, SAR imaging and moving target detection, antiradiation missile (ARM) detection, sea target detection and radar signal recognition, et al.. In the end, future research interests are pointed out according to the problems of present study.

Keywords: Moving target detection   Target Recognition   Linear frequency modulation (LFM) Signal   FRactional Fourier transform (FRFT)   Transform angle   Sea clutter

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