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### 算法研究

## 基于低速采样的多正弦波信号频率估计

叶丰, 罗景青, 陈明建, 唐希雯

合肥电子工程学院电子对抗信息处理重点实验室

### 摘要:

高频段信号由于受到A/D转换器和后续信号处理器件运算速度和成本的限制, 其处理往往难以实现, 为解决此问题, 提出了一种新的基于低速采样的高频段多正弦波信号频率估计方法。首先将含有多个频率互异的多正弦波信号经过功分器分成两路信号, 然后分别用不同的采样率对这两路信号进行低速采样, 用傅立叶变换及基于改进的Rife算法与Quinn算法来估计两路信号低速采样后的频率, 接下来利用中国余数定理对多个信号的频谱快速配对解模糊准确的估计出各个信号的频率。该方法在工程上易于实现, 可同时实现低的采样速率与高精度估计, 而且在较低信噪比的情况下仍可获得较高的估计精度。给出了该方法的具体步骤, 通过计算机仿真试验验证了该方法的有效性。

关键词: 低速采样; 多正弦波信号; 中国余数定理; 频谱配对; 低信噪比

## Multiple frequencies estimation of sinusoidal signals with sub-sampling

YE Feng, LUO Jing-Qing, CHEN Ming-Jian, TANG Xi-Wen

Electronic Engineering Institute, laboratory of electronic countermeasure and information processing, Hefei

### Abstract:

In some applications, it is hard to process high-frequency signals because of the constraint of A/D converter and latter signal processors' low computation speed and high cost. A new method of multiple frequencies estimation of high-frequency sinusoidal signals based on sub-sampling is proposed. First use the power divider to make the high-frequency multiple sinusoidal signals into two pathway, then the two signals are sampled with different sampling rate respectively, using the Fourier transformation and improved Rife-Quinn algorithm to estimate the two separate frequencies. Then estimate the multiple frequencies unambiguously via spectral rapid-pairing utilizing the Chinese remainder theorem. This approach has the advantages of low cost, low sampling rate, high precision and easy implementation, even if in the very lower signal noise ratio (SNR). Step of this method is provided and simulations have verified the validity of the algorithm.

Keywords: sub-sampling multiple sinusoidal signal Chinese remainder theorem spectral pairing; low signal to noise ratio

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通讯作者:

作者简介:

作者Email: yefeng19880521@163.com

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