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电力系统

纳托尔自卷积窗加权电力谐波分析方法

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摘要：

摘要：在非同步采样下，采用快速傅里叶变换进行电力谐波分析容易造成频谱泄露和栅栏效应。窗函数加权可有效抑制频谱泄漏，但经典窗函数的抑制能力受旁瓣性能的制约。分析了纳托尔(Nuttall)窗的频谱特性后，提出了一种通过若干Nuttall窗自卷积运算得到的新型窗函数——Nuttall自卷积窗。分析了Nuttall自卷积窗的主瓣、旁瓣性能，建立了Nuttall自卷积窗加权的改进FFT谐波分析方法。与经典窗函数相比，Nuttall自卷积窗优良的旁瓣性能可有效抑制频谱泄漏的影响，改进FFT算法能有效克服卷积带来的频率分辨率降低的问题。仿真结果表明，Nuttall自卷积窗抑制频谱泄漏效果好，改进FFT算法能对结果进行有效修正，谐波参数估计准确度优于经典窗函数。

关键词： 谐波分析 纳托尔(Nuttall)自卷积窗 旁瓣性能 快速傅里叶变换

A Nuttall Self-Convolution Window-Based Approach to Weighted Analysis on Power System Harmonic

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Abstract:

ABSTRACT: The signal spectral leakage and fence effect are prone to take place during the power harmonic analysis by fast Fourier transforem (FFT) under non-synchronous sampling. Although the signal spectral leakage can be effectively inhibited by weighted window function, however the inhibiting ability of classical window function is restricted by the behavior of sidelobe. Based on the analysis on spectrum characteristic of Nuttall window, a new type of window function, namely the Nuttall self-convolution window, is obtained by several Nuttall window self-convolution operations. Analyzing the behaviors of mainlobe and sidelobe of Nuttall self-convolution window, an improved FFT harmonic analysis method adopting weighted Nuttall self-convolution window is developed. The excellent sidelobe performance of Nuttall self-convolution window can effectively suppress the influcence of siganl spectral leakage than classical window function and the improved FFT algorithm can effectively remedy the defect in frquency resolution reduction brought about by convolution. Simulation resutls show that Nuttall self-convolution window can well suppress frequency spectral leakage; the improved FFT algorithm can effectively modify the results; and the accuracy of harmonic parameter estimation by the proposed method is better than that by classical window function.

Keywords: harmonic analysis Nuttall self-convolution window sidelobe behavior fast Fourier transform

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