UFMC 系统中基于 Volterra 滤波器的非线性失真补偿方案

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摘　要： 为实现通用滤波多载波(UFMC)通信系统高效、可靠的通信性能，需在最大程度上补偿由记忆型高功率放大器(HPA)引起的非线性失真.为解决 HPA 造成的失真问题，本文提出了一种基于 Volterra 滤波器的非线性失真补偿(V-NLDC)技术.该技术利用了 Volterra 级数的稀疏特性和能够模拟任意精度非线性系统的性质以逐次逼近的方式对信号进行预失真.将预失真后的信号传送至 HPA，然后采用噪声消除器做进一步噪声消除处理，以达到更小失真度的目的.同时，本研究采用收敛速度快、性能稳定的自适应最小二乘法(RLS)，可根据环境变化自适应地计算 Volterra 滤波器和噪声消除器的系数.通过大量蒙特卡罗仿真实验证实了所提出的非线性失真补偿技术可以很好的补偿由记忆型 HPA 非线性失真所造成的影响，从而优化系统性能.

关键词： 通用滤波多载波；高功率放大器；非线性失真补偿；Volterra 滤波器；自适应最小二乘法

Nonlinear distortion compensation method based on Volterra filter in UFMC system

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Abstract： In order to achieve efficient and reliable communication performance of the universal filter multi-carrier (UFMC) system, it is necessary to compensate for the nonlinear distortion caused by high power amplifier (HPA) with memory. In this paper, nonlinear distortion compensation method based on Volterra filter (V-NLDC) is proposed to solve the nonlinear distortion problem caused by HPA. Where, by using the Volterra series property of sparsity and accurate representation of nonlinear system, pre-distortion is first processed to modify transmitter signal with successive method. And secondly the pre-distorted signal is transmitted to HPA and finally further noise elimination is performed using a noise canceller to achieve a smaller distortion. In the whole process, the adaptive recursive least-square (RLS) method with fast convergence speed and stable performance is used to calculate the coefficients of Volterra and linear filters based on different environment. Through Monte Carlo simulation experiments, it is confirmed that the nonlinear distortion compensation technique can compensate for the influence caused by memory HPA nonlinear distortion and optimize the system performance.

Key words： universal filter multi-carrier; high power amplifier; nonlinear distortion compensation; Volterra filter; recursive least-squares

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