Walsh矩阵的复制生成及其计算机图像

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Abstract

Walsh functions are widely used in many areas such as signal and image processing, digital communication etc. Walsh function system is orthogonal and completed. Among many methods to generate Walsh functions, Swick's copy theory is famous. This method takes Walsh function's order numbers as the copy information and can generate an arbitrary function given certain order number, which in fact is the vector processing method and is not applicable for such 2D signal processing applications as fast transforms. Walsh function system can be expressed by Walsh matrix Wk. In this paper, row copy and block copy methods are put forward based on Wk. Copy operators are designed based on symmetries and a new ordering is discovered (named Walsh-Like ordering). After the iterative formulas of 6 ordering Walsh matrices are deduced by Kronecker product, the computer images of these matrices are illustrated. It is proved that the proposed method is more advanced than the former. The later can achieve higher performance and is applicable to the fast transforms designing. The fourth symmetric ordering of Walsh function system is discovered (Walsh-Like ordering), and the conjecture that the new ordering is likely to be the reverse form of Walsh ordering is made by analyzing and comparing with these images.

摘要

Walsh函数在信号处理、图像处理、通信等众多领域有着广泛的应用.Walsh函数系是一个正交而完备的函数系,可以通过多种方法生成这一函数系.其中,Swick提出的复制方法应用最为广泛,该方法以Walsh函数的序码作为复制信息,可以复制出任意给定序数的Walsh函数.其本质是基于向量的处理,不适于类似快速变换等二维信号的处理.Walsh函数系可用Walsh方阵Wk表示.提出了基于Wk的行复制和块复制方法.基于对称性引入复制算子,并发现了一种新序(类Walsh序).利用Kronecker积推导了6种序的Walsh方阵的递推公式并绘制了它们的计算机图像,发现这些图像具有分形意义上的自相似结构.结果表明,基于矩阵的复制是比基于序码的复制更先进的复制方法.前者性能更优,适于快速变换的设计.而且,利用它发现了Walsh函数系的第4种对称的序:类Walsh序.通过分析和比较各种序的计算机图像,得出类Walsh序更适合作为Walsh序的逆反形式的

猜想.

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