

广义稳健的中国剩余定理及其在欠采样率下频率估计中的应用

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A Generalized Robust Chinese Remainder Theorem and Its Application to Frequency Estimation with Undersampling

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摘要

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摘要 该文针对传统中国剩余定理在余数有误差时重构整数不稳健性的缺陷,提出了采用一组非互质的模数和相应的有误差的余数估计任意正整数的广义稳健中国剩余定理,给出了详细的定理证明,得出了算法重构整数公式和误差上限表达式。将该定理用于欠采样下信号频率估计,仿真实例验证了所提算法的稳健性和实际工程应用前景。

关键词: 信号处理 中国剩余定理 广义稳健中国剩余定理 欠采样 频率估计

Abstract: The Chinese remainder theorem is not robust in the sense that a small error in its remainders may cause a large error in the determined integer by the CRT. In this paper, a Generalized Robust Chinese Remainder Theorem (GRCRT) is presented when moduli are not pair-wisely co-prime and the remainders have errors. The new theorem is proofed in detail; The formulas of the estimated integer and estimation error upper bound are provided. The RCRT is then applied to determine the frequency when the signal waveforms are undersampled. Simulation results show that new algorithm is robust with considering residue errors and can use to the area of digital signal processing and will have more applications to other areas.

Keywords: Signal Processing Chinese Remainder Theorem (CRT) Generalized Robust Chinese Remainder Theorem (GRCRT) Undersampled Frequency estimation

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