

传感器动态误差高速并行修正方法及其FPGA实现

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摘要:

为了运用动态补偿器来修正由传感器系统特性引起的动态误差, 提出了一种基于改进粒子群优化(PSO)算法的动态补偿器设计方法, 该方法有效的克服了PSO算法的初始值对补偿器系数的影响。为了将获得的最优动态补偿器运用于实时在线测量, 将分布式算法引入到动态补偿器的硬件结构设计中, 完成了传感器动态补偿器的高速并行FPGA实现。实验表明高速并行动态补偿器不但能够修正传感器的动态误差, 而且其高速并行结构极大减少了对FPGA资源的占用率并有效的提高了系统等效吞吐率。

关键词: 动态误差; 改进粒子群优化算法; 分布式算法; FPGA; 动态补偿器;

FPGA Implementation of High Speed Parallel Correction for Sensor's Dynamic Error

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Abstract:

In order to correct the error caused by dynamic characteristics of sensor using dynamic compensator, a design method of dynamic compensator based on improved particle swarm optimization (PSO) algorithm is presented. With this method, the parameters of the compensator avoid the influence of PSO algorithm's initial conditions. To realize real-time correction for sensor's dynamic error, the high speed parallel structure of optimized compensator is designed by using the distributed arithmetic and it is realized in FPGA chip. The experimental results show that the high speed parallel compensator does not only corrects sensor's dynamic error, but also cuts down the consumption of hardware resources greatly and improves the sampling rate of system effectively.

Keywords: dynamic errors; improved PSO algorithm; distributed arithmetic; FPGA; dynamic compensator

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