面向 FPGA 的惯性导航算法的研究与实现

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摘要： 针对当前飞控系统中传感器多、运算量庞大，传统微处理器已难以满足其日益增长的性能需求，本文提出了一种面向 FPGA 的并行化惯性导航算法.本算法采用扩展卡尔曼滤波对结果做最优估计，四阶龙格库塔算法进行积分估计，同时将惯性导航算法进行模块化分割，采用流水线并行处理，提高解算速度.利用 FPGA 开发板驱动传感器，并在该 FPGA 上实现对数据的解算，解算结果由接口传输给微处理器，降低了对微处理器接口和性能的要求.最后仿真结果表明，本算法在速度和精度上均有良好的表现，验证了该算法在 FPGA 上实现的可行性.
关键词： 惯性导航算法；FPGA 开发板; 扩展卡尔曼滤波；龙格库塔算法

Research and Implementation of Inertial Navigation Algorithm for FPGA

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Abstract： Aiming at the problem that the sensor in the current flight control system is to many and the computational complexity is large, the traditional microprocessor has been difficult to meet its growing performance requirements. This paper presents a parallel adaptive inertial navigation algorithm for FPGA. In this algorithm, the extended Kalman filter is used to estimate the result. The fourth-order Runge-Kutta algorithm is used to estimate the integral. At the same time, the inertial navigation algorithm is modularized and the parallel processing is used to improve the solution speed. The FPGA development board is used to drive the sensor, and the data is solved on the FPGA. The result of the solution is transmitted from the interface to the microprocessor to reduce the interface and performance requirements of the microprocessor. Finally, the simulation results show that the proposed algorithm has good performance in terms of speed and accuracy, and verifies the feasibility of the algorithm on FPGA.
Key words： INS; FPGA; Extended Kalman Filter(EKF); Runge-Kutta algorithm

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