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现代应用光学

用于三点定位的激光发射追踪系统

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摘要： 为研制适用于南方小面积农田的小型农机定位系统，基于激光三点定位原理设计了一套应用双激光源三点定位的激光发射追踪系统。讨论了双激光源三点定位原理，重点描述了激光发射追踪系统的机械结构设计与控制处理电路设计，并提出了基于增量式PID、具有快速修正功能的卡尔曼滤波追踪算法，解决了激光追踪中的移动目标预估与转弯及变速过程中的误差补偿问题。一系列实验结果表明：不同速度下，两个激光发射器所发射的激光均能较好地追踪激光接收器靶标中心，最大偏差为±2.8 cm，能满足200 m内误差小于±4 cm的作业机械定位需求。所提出的算法可靠有效，为农田作业机械无人驾驶和田间数据定点采集奠定了基础。

关键词： 激光发射追踪系统 三点定位 卡尔曼滤波 小型农机具

Laser emitting and tracking system used for three-point location

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Abstract: To develop a location system for small agricultural machines in the Chinese south, a laser emitting and tracking system based on double laser-emitter and three-point location was designed based on the laser three-point theory. The theory of double-laser-emitter and three-point location was introduced; then, the laser emitting and tracking system was designed, including the designs of working mechanism and controlling circuit for the laser emitter. The Kalman filtering algorithm based on a incremental PID with quick correction functions was proposed to estimate the moving targets in laser tracking and to compensate the errors in changing speeds and turning corner of the machine. A series experiments were performed. The experiment results show that the targets of laser receiver can be tracked dynamically by both laser emitters in real-time, and the maximum deviation is ±2.8 cm, which meets the location requirement of an autotracked-driving farming machine for an accuracy of ±4 cm within 200 m. For the reliable and effective algorithm, it can lay a foundation for unmanned driving of farmland machines and data collection in farming fields.

Keywords: Laser emitting and tracking system three-point location Kalman Filter small agriculture machine

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