Research and application of high-power pruning robot based on RTK positioning and heavy load mountings

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Abstract

Aiming at the problem that short circuit tripping may be caused by the insufficient safe distance between trees and lower phase conductors in high voltage transmission line corridors, a high-power pruning robot with RTK positioning and heavy-load mounting is studied and designed, which includes five modules: mathematical model and control principle of multi-rotor UAV, multi-rotor auxiliary obstacle avoidance control system, RTK aircraft positioning, UAV digital video transmission, and remote control cutting. First of all, according to the analysis of working space, the configuration principle of a high-power pruning robot based on RTK positioning and heavy-load mounting is put forward, and the three-dimensional model is set up. The finite element stress-strain analysis and modal analysis of the combined insulation clamping arm are carried out by using ABAQUS software, and the minimum mass solution that meets the mechanical performance requirements is given, which is 15.3% lower than that of similar robots, and the load capacity of trimming tools is increased by 20.2%. Secondly, the mathematical model of a multi-rotor UAV is established, and the multi-rotor auxiliary obstacle avoidance control system is designed. The control accuracy is 10.1% higher than that of the traditional control system, and the positioning of RTK aircraft is realized. In addition, based on RTK positioning, three design schemes of pruning robots are given: pruning tool and camera handling, UAV tree obstacle pruning control, and UAV tree obstacle removal. Finally, the prototype has carried out several heavy-load pruning tests on 220KV live lines, and the test results show that the prototype meets the tree pruning requirements of 220KV live lines, and the pruning accuracy is 89.42% higher than that of similar robots, and the live working time is extended by 26.8%, which verifies the rationality and practicability of the design.

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