A new energy-efficient control approach for astronomical telescope drive system

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Drive control makes the astronomical telescope accurately tracking celestial bodies in spite of external and internal disturbances, which is a key technique to the performance of telescopes. In this paper, we propose a nonlinear adaptive observer based on power reversible approach for high precision telescope position tracking. The nonlinear adaptive observer automatically estimates the disturbances in drive system, and the observed value is applied to compensate for the real disturbances. With greatly reduced disturbances, the control precision can be evidently improved. In conventional drive control, the brake device is often used to slow down the reaction wheel and may waste enormous energy. To avoid those disadvantages, an H-bridge is put forward for wheel speed regulation. Such H-bridge has four independent sections, and each section mainly consists of a power electronic switch and an anti-parallel diode. During the period of the mount slowing down, the armature current of drive motor goes
through the two path-wise diodes to charge the battery. Thusly, energy waste is avoided. Based on the disturbance compensation, an optimal controller is designed to minimize an evaluation function which is made up of a weighted sum of position errors and energy consumption.The outputs of the controller are applied to control the H-bridge. Simulations are performed
in MATLAB language. The results show that high precision control can be obtained by the proposed approach. And the energy consumption will be remarkably reduced.