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Dual-Motor Drive Image Stabilization System for Elevation-Azimuth Photoelectric Survey Telescope under Long Exposure

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Abstract: Elevation-Azimuth Photoelectric Survey Telescopes (Ele-Azimuth PST) working under long exposure station is very important for observing weak targets in space. The motion characteristics analyses including position and velocity of rotating targets show that the image stabilization system (IMSS) needs to have a self-locking capability, low temperature rise, anti-interference, high-speed switching and ultra-low-speed tracking performance. A dual motor IMSS with self-locking was adopted after comparison. In this work, in order to overcome the inherent uncertainties affecting the accurate tracking of a target in a dual motor drive gear of the IMSS, we introduce a compound control strategy including bias torque controller (BTC) in current-loop and active disturbance rejection controller (ADRC) in velocity-loop. Experimental results show that the proposed controller can effectively eliminate backlash of IMSS, and the fixed-point control accuracy can achieve 0.18arcsec. When the sinusoidal speed guidance is 0.068 sin (2π *0.01*t) (°/s) and position guidance is cos (2π *0.01*t) (°), the position error is 0.31 arcsec. After image stabilization, the imaging resolution can be guaranteed to reach within 0.5-pixel size under the 60s exposure time.