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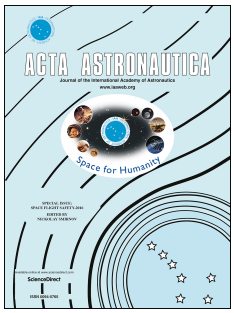

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Overload control of artificial gravity facility using spinning tether system for high eccentricity transfer orbits

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Abstract: As the major part of space life supporting systems, artificial gravity requires further study before it becomes mature. Spinning tether system is a good alternative solution to provide artificial gravity for the whole spacecraft other than additional devices, and its longer tether length could significantly reduce spinning velocity and thus enhance comfortability. An approximated overload-based feedback method is proposed to provide estimated spinning velocity signals for controller, so that gravity level could be accurately controlled without complicated GPS modules. System behavior in high eccentricity transfer orbits is also studied to give a complete knowledge of the spinning stabilities. The application range of the proposed method is studied in various orbit cases and spinning velocities, indicating that it is accurate and reliable for most of the mission phases especially for the final constant gravity level phase. In order to provide stable gravity level for transfer orbit missions, a sliding mode controller based on estimated angular signals is designed for closed-loop control. Numerical results indicate that the combination of overload-based feedback and sliding mode controller could satisfy most of the long-term artificial gravity missions. It is capable of forming flexible gravity environment in relatively good accuracy even in the lowest possible orbital radiuses and high eccentricity orbits of crewed space missions. The proposed scheme provides an effective tether solution for the artificial gravity construction in interstellar travel.

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