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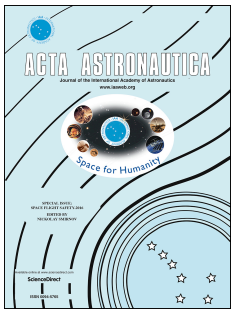

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Integrated identification and control for nanosatellites reclaiming failed satellite

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Abstract

Using nanosatellites to reclaim a failed satellite needs nanosatellites to attach to its surface to take over its attitude control function. This is challenging, since parameters including the inertia matrix of the combined spacecraft and the relative attitude information of attached nanosatellites with respect to the given body-fixed frame of the failed satellite are all unknown after the attachment. Besides, if the total control capacity needs to be increased during the reclaiming process by new nanosatellites, real-time parameters updating will be necessary. For these reasons, an integrated identification and control method is proposed in this paper, which enables the real-time parameters identification and attitude takeover control to be conducted concurrently. Identification of the inertia matrix of the combined spacecraft and the relative attitude information of attached nanosatellites are both considered. To guarantee sufficient excitation for the identification of the inertia matrix, a modified identification equation is established by filtering out sample points leading to ill-conditioned identification, and the identification performance of the inertia matrix is improved. Based on the real-time estimated inertia matrix, an attitude takeover controller is designed, the stability of the controller is analysed using Lyapunov method. The commanded control torques are allocated to each nanosatellite

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