

A Reduced Dimensional Gimbal Rate Steering Law for Singularity-Free Control

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In using single-gimbal control moment gyros (SGCMGs) for spacecraft attitude control, geometric singularity problem is one of the principal difficulties. The steering laws to avoid singular conditions have been extensively studied, however, those steering laws are not fully satisfying to avoid singularity problem. A new steering logic is suggested in this paper, which results in reducing the difficulties in generating gimbal rate steering law around singularities. By adopting the singular value decomposition (SVD) in reduced dimensional forms, the steering law is generated in a series of rate steering laws. The insufficiency in generated torque has been compensated by a successive calculation of steering laws. To verify the performance of this logic, simulations are implemented at several singular conditions and compared with other singularity avoidance laws, such as singularity robustness steering law and singular direction avoidance steering law.