Title: **Assessment of Per-Axis Thruster Control Authority of Cassini Spacecraft for Low-Altitude Titan Flybys**

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Abstract:

The Cassini-Huygens mission is an international venture involving the National Aeronautics and Space Administration (NASA), the European Space Agency (ESA), and several separate academic and industrial partners. The mission will explore the Saturnian system beginning July 2004. Upon arrival at Saturn, Cassini will execute numerous low-altitude flybys of Saturn's largest moon, Titan. Titan is the only moon in the solar system with a substantial atmosphere. At the closest approach altitudes of 950 km, the spacecraft must use its thrusters in order to overcome the external torques, maintain three-axis attitude control, and perform the required science slews. Because of the uncertainties associated with Titan atmospheric density model, as well as the projected area of the spacecraft, center of mass and center of pressure locations, thrust force magnitude, and flyby altitude and velocity, the adequacy of thruster control authority at the closest approach must carefully be assessed. This is to ensure that Cassini, this largest and most sophisticated outer planet spacecraft ever built, will not tumble out of control. The results indicate that even when both the atmospheric torque and the thruster control authority are estimated conservatively, there still exists adequate control authority margin. The thrusters can still provide more torque than is needed to overcome all the torques experienced by the spacecraft and no attitude control error monitor will be triggered.

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