H2 and H∞ control options for the combined attitude and thermal control system (CATCS)

ABSTRACT

The combined attitude and thermal control system (CATCS) combines the conventional attitude control and thermal control subsystems. Its principle is based on circulating a heat conducting fluid inside a closed duct wielding the excess onboard heat in order to produce the attitude control torques. Previously only the proportional-integral (PI) controller has been tested for CATCS. In this paper two other control options for CATCS were designed based on the H2 and H∞ control methods to improve the attitude control performance of a small satellite. The control gain matrix with the minimum cost function is obtained by solving the Riccati equation and fed back to the system in order to achieve the system's performance. The designed controllers can efficiently control the roll, pitch and yaw satellite attitudes. Simulations for the two techniques were carried out using Matlab and Simulink for ideal and non-ideal system models. Results show that the H2 controller has a better attitude control performance over the H∞ controller and PI controller itself.

Keyword: H2 controller, H∞ controller, Attitude control, CATCS