LMI-based Mixed H_2/H_∞ Control with Regional Constraints for Spacecraft Attitude Tracking

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Satellite dynamics is described by a nonlinear differential equation. Most of recent studies about attitude control have used non-linear controllers. However, with these controllers, control performance is ignored in most cases. To overcome this problem, we applied Linear Parameter-Varying (LPV) theory to attitude control [1]. In this paper, we deal with mixed H_2/H_∞ control with regional pole constraints as follows:

1) α stabilization constraint:

$$(AX - BW) + (\cdot)^T + 2\alpha X < 0 \tag{1}$$

2) Circle stabilization constraint:

$$\begin{bmatrix} -rX & AX - BW \\ * & -rX \end{bmatrix} < 0 \tag{2}$$

3) Conic-sector stabilization constraint:

$$\begin{bmatrix} \sin\theta\{(AX - BW) + (\cdot)^T\} & \cos\theta\{(AX - BW) - (\cdot)^T\} \\ * & \sin\theta\{(AX - BW) + (\cdot)^T\} \end{bmatrix} < 0 \tag{3}$$

Figure 1 shows the region of Eqs. (1)-(3) and in Fig. 2, the upper figure shows a simulation result of the error quaternion of a spacecraft by the mixed H_2/H_∞ controller. On the other hand, the lower one shows that of the mixed H_2/H_∞ controller with the regional pole constraints.
From these figures, compared with the former one, the later one has achieved better performance.

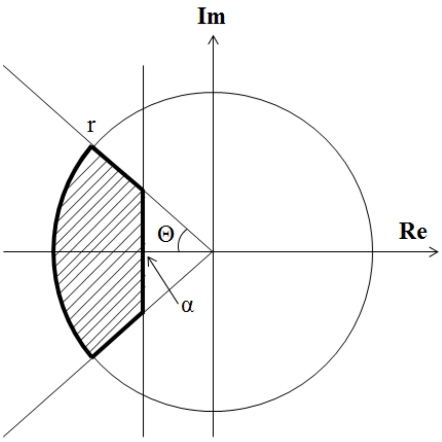

Fig. 1 Regional pole constraints.

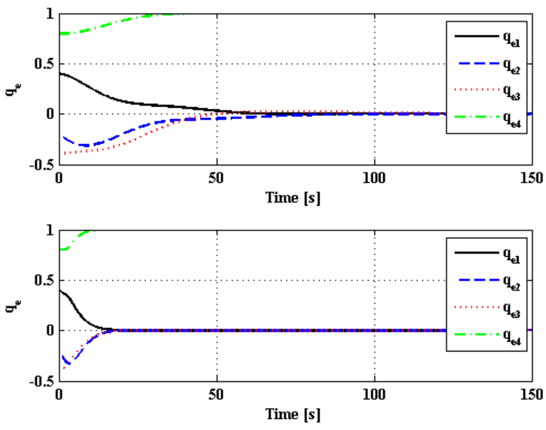

Fig. 2 Control results of the error quaternion with or without regional constraints.

References

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