
Summary: In this paper, the guaranteed cost spacecraft attitude stabilization problem is investigated through solving a linear partial differential equation (PDE). It is proved that the guaranteed cost spacecraft attitude controller design problem under actuator misalignments and disturbances can be reformulated into the problem of solving the linear PDE only once. It is also shown that the optimal guaranteed cost controller can be further designed through recursively solving the linear PDE. To alleviate the computational cost and implement the proposed guaranteed cost controller in higher dimensions, a nested sparse grid Chebyshev spectral collocation method is developed. Taking advantage of the designed numerical method, the resultant linear PDE is transformed into an efficiently solvable quadratic programming (QP) problem, and the controller can then be constructed analytically. Simulations show that the proposed controller successfully stabilizes the nonlinear system and also provides an upper bound for the defined performance index.

MSC:

93D21 Adaptive or robust stabilization
93C95 Applications models in control theory
93C20 Control/observation systems governed by partial differential equations
93C05 Linear systems in control theory
90C20 Quadratic programming

Software:

CVX; Spinterp; nwSpGr

Full Text: DOI

References:

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