Magnetic Torquer Attitude Control of a Satellite Via the Linear Quadratic Regulation and the State-Dependent Riccati Equation Technique

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An attitude control technique of a satellite with magnetic torquers has been developed. The aim of this control system is to achieve a stable attitude within 5 deg, maximizing the pointing accuracy and minimizing the control energy, under the limitation of the existing low-cost technology. Based on the characteristics of the magnetic control system, magnetic-torquer-based attitude control design process is studied. More detailed and precise linearized equation of motion for this system is also presented using the unit quaternion. This linearized equation of motion forms a Time-Invariant system. The Linear Quadratic Regulator method using the solution of the Steady-State Riccati Equation(SSRE) is applied to this linearized system. Simulation studies for this method were performed numerically on Matlab and Simulink. As a further study, a control method for the nonlinear system using the State-Dependent Riccati Equation(SDRE) technique is being developed.