Model Error Compensator for Attitude Control of 2-Wheel Spacecraft with On-line FRIT based Tuning

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The attitude control is essential for the spacecraft as shown in Fig. 1 to achieve the various missions. Generally, high orientation accuracy is required for the attitude control. One of the methods of attitude control is three-axis stabilization using a reaction wheel (RW). However, the reaction wheel has the potential to fail in the long mission without being able to tolerate severe environments of the outer space because a reaction wheel is an electronic device. Because of this, there is a case where the mission was interrupted because the highly accurate attitude control cannot be performed. As the method to solve this problem, the attitude control using two RWs in consideration of initial angular momentum has been proposed by Katsuyama et al. [1].
In this method, the accurate model parameters are indispensable for using the model based control. However, it is difficult to obtain an accurate model, and there are cases where the model parameters fluctuate in the real environment. The high accurate attitude control cannot be achieved because the control performance deteriorates when such a model error exists in the model base control. To solve this problem, the method of estimating and correcting model parameters by optimization calculation using the L1-regularization by the least squares method has been proposed [2]. By using this method, the spacecraft can achieve control target when the model error exists. However, this method only considers the error of model parameters. On the other hand, operation is required to achieve the control objective with the expected movement even if the model error exists. Therefore, Operation is required to achieve the control target with the expected movement of the spacecraft in the unknown environment space. Therefore, we propose a method to correct the input so as to follow the motion of the ideal model by applying model error compensator (MEC) using fictitious the on-line reference iterative tuning (FRIT) shown in Fig. 2. This method can treat the larger class of model error not only the parameter differences. The validity of this proposed method is verified by numerical simulations.

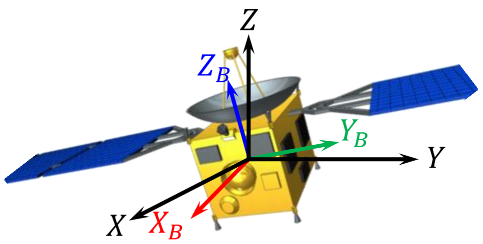

Fig. 1 Example of the spacecraft

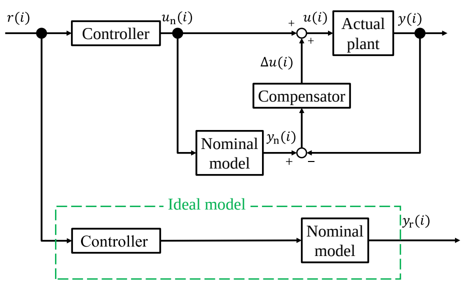

Fig. 2 Structure of MEC using FRIT

References
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