I-FP03 Spacecraft Control

13:00-15:00 **Chair : Kim Jae Hoon (ETRI)**
Room : C202 **Co-Chair : Sim Eunsup (KARI)**

13:00 – 13:20 **I-FP03-1**

Sliding Mode Control of Spacecraft with Actuator Dynamics

Yee-Jin Cheon, Jung-Hoon Keum, and Eunsup Sim
(KARI)

sliding mode control of spacecraft attitude tracking with actuator, especially reaction wheel, is presented. The sliding mode controller is derived based on quaternion parameterization for the kinematic equations of motion. The reaction wheel dynamic equations represented by wheel input voltage are presented. The input voltage to wheel is calculated from the sliding mode controller and reaction wheel dynamics. The global asymptotic stability is shown using a Lyapunov analysis. In addition the robustness analysis is taken for nonlinear system with parameter variations and disturbances. It is shown that the controller ensures control objectives for the spacecraft with reaction wheels.

13:20 – 13:40 **I-FP03-2**

Time Optimal Attitude Maneuver of Three-Axis Spacecraft with only Magnetic Toquer

K.M.Roh, K.H.Choi, J.H.Kim (Yonsei Univ.),
Sanguk Lee(ETRI)

This paper presents the time optimal reorientation solution of three-axis spacecraft which has only three magnetic torquers. It has been very difficult problem because the magnetic torquer generates only perpendicular to Earth magnetic field vector. In this paper, minimum-time solution using only magnetic torquer is solved using collocation method and nonlinear programming solver NPSOL. IGRF Earth magnetic field model used to simulate magnetic field. The result is verified by comparing to the result of numerical integration. The solution is obtained for the various reorientation maneuver of three axes rigid spacecraft. And the results show that all three axes of rigid spacecraft are controlled effectively only by magnetic torqure.

13:40 – 14:00 **I-FP03-3**

H∞ Controllers for Symmetric Systems: A Theory for Attitude Control of Large Space Structures

Masao Ikeda, Kazuhiro Miki(Osaka Univ.),
Guisheng Zhai(Wakayama Univ.)

This paper is concerned with robust attitude control of large space structures with collocated sensors and actuators. Since the transfer function matrices of such systems are symmetric, it seems suitable to employ symmetric controllers. This paper shows that it is true if no constraint is imposed on the orders of the controllers, but it is not true if the orders of the controllers are specified to be lower than that of the system to be controlled.

14:00 – 14:20 **I-FP03-4**

Estimation of the General Along-Track Acceleration in the KOMPSAT-1 Orbit Determination

Byoung-Sun Lee, Jeong-Sook Lee, and Jae-Hoon Kim
(ETRI)

Estimation of the general along-track acceleration was performed in the KOMPSAT-1 orbit determination process. Several sets of the atmospheric drag and solar radiation pressure coefficients were also derived with the different spacecraft area. State vectors in the orbit determination with the different spacecraft area were compared in the time frame. The orbit prediction using the estimated coefficients was performed and compared with the orbit determination results. The orbit prediction with the different general acceleration values was also carried out for the comparison.

14:20 – 14:40 **I-FP03-5**

Mission Operations of the KOMPSAT-1 satellite

Hae-Dong Kim, Eun-Kyou Kim, and Hae-Jin Choi
(KARI)

The KOMPSAT-1(Korea Multi-Purpose Satellite-1) is the first multi-purpose satellite funded by Korean government for the purpose of remote sensing and scientific data gathering in KOREA. It has successfully achieved its own mission since Dec. 21, 1999. This paper provides an overview of the KOMPSAT-1 missions and addresses the nominal mission planning and operation flow. This paper also describes the routine operational orbit determination and orbit prediction process using GPS navigation solution data. Meanwhile, some problems due to inexperience of the multiple mission operations during LEOP(Launch & Early Orbit Phase) and early normal mission were investigated. Then, resolutions that include the development of new mission planning tool are addressed. The KOMPSAT-1's missions become more complicated rather than its initially designed ones. In order to accomplish ...

14:40 – 15:00 **I-FP03-6**

Real-Time Software Design using VxWorks for MSC(Multi-Spectral Camera) on KOMPSAT-2

Haeng-Pal Heo, Sang-Soon Yong, Jong-Pil Kong, Young-Sun Kim,
and Heong-Sik Youn (KARI)

MSC is being developed to be installed on KOMPSAT(Korea Multi-Purpose Satellite)-II and to provide high resolution muiti-spectral. MSC consists of three main subsystems. One is EOS(Electro-Optics Subsystem), another is PMU(Payload Management Unit) and the other is PDTS(Payload Data Transmission Subsystem). There is an SBC(Single Board Computer) in the PMU to control all MSC subsystems. SBC incorporates Intel 80486 as a main processor and VxWorks as a real-time operating system. SBC software consists of four main tasks and several modules to deal with all control information for imaging and all the state of health telemetry data, and to perform interface with another MSC units. SBC software also has to handle a lot of commands in order for MSC to perform his mission. One mission command consists of a series of related commands, which are to be executed in the designated sequence, with a specified time ...