an increase in aperture and/or in number of optical elements within the system. However, in practice, the alignment of multiple optical components tends to be rather difficult task because of the multiple coupling effects among the elements within the target system. In order to understand and hence identify the complex interplay of the wavefront coupling effects from the alignment process, the original differential wavefront sampling(DWS) method was presented elsewhere in recent years. DWS uses partial differential of the wavefront of optical component and perturbation value of the optical component against a particular alignment factor. The straightforward application of DWS for an off-axis optical system revealed that it tends to give incorrect estimation of the given misalignment state. In this study, we added off-axis correction terms to the original DWS algorithm and investigated its alignment performance. The performance simulation result for a Korsch type space optical system shows that the modified DWS is capable of bringing the misaligned system into the target alignment tolerance only after 3 iterations. It also shows that this new improved algorithm can be used to estimate the source misalignment as well. We are planning to apply this method for the alignment of a 800mm Korsch type telescope in the near future. We discuss the computational technique, simulation results and implications in details.

[V-2-4] Development of an Earth Observation Optical Payload Simulator

Jong-hoon Lee[1], Jun Ho Lee[1], and Yee-Jin Cheon[2]

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The importance on the simulation of earth observation optical payloads has been recently emphasized in order to estimate on-orbit imaging performance of the payloads. The estimation should consider all aspects of payload development; design, manufacture, test, assembly, launch and space environment. Until recently several studies have been focused the evaluation of the individual factors rather than the integrated. This paper presents the development of an integrated payload simulator. The simulator analyzes the payload imaging performance based on MTF(Modulation Transfer Function) calculations of the major factors (Diffraction, Aberration, Detector integration, Image motion and etc.) and the simulator can generate realistic artificial earth images as taken by defined earth observation payloads. The simulator is developed for the use of evaluating pre- and post-launch imaging performance and assisting on-board calibration of COMPSAT-3.

[V-2-5] Radiometric performance characterization for breadboard AMON-RA energy channel instrument for deep space albedo measurement

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The Albedo MONitor and RAdiometer (AMON-RA) instrument system is designed to measure Earth global albedo anomaly over the wavelength range of 0.3um to 4um. The instrument consists of two interconnecting optical subsystems i.e. a visible channel and an energy channel. The energy channel instrument consists of a modified Winston cone, a couple of relay mirrors and a pyro-electric detector. First, we report the integration and alignment process, leading to the prototype bolometer instrument. We then discuss the radiometric performance characterization including laboratory measurement results and the future plan for further incorporation of the bolometer instrument into the prototype AMON-RA instrument.

■ Session VI-2 : Satellites 2

Thursday, 23 October [11:25-12:25]

[VI-2-1] Development of Hardware-in-the-loop Simulator for Spacecraft Attitude Control using thrusters

Dong-Wook Koh, Sang-Young Park, and Kyu-Hong Choi

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The ground-based spacecraft simulator is a useful tool to realize various space missions and satellite formation flying in the future. Also, the spacecraft simulator can be used to develop and verify new control laws required by modern spacecraft applications. In this research, therefore, Hardware-in-the-loop (HIL) simulator which can be demonstrated the experimental validation of the theoretical

results is designed and developed. The main components of the HIL simulator which we focused on are the thruster system to attitude control and automatic mass-balancing for elimination of gravity torques. To control the attitude of the spacecraft simulator, 8 thrusters which using the cold gas (N2) are aligned with roll, pitch and yaw axis. Also Linear actuators are applied to the HIL simulator for automatic mass balancing system to compensate for the center of mass offset from the center of rotation. Addition to the thruster control system and Linear actuators, the HIL simulator for spacecraft attitude control includes an embedded computer (Onboard PC) for simulator system control, Host PC for simulator health monitoring, command and post analysis, wireless adapter for wireless network, rate gyro sensor to measure 3-axis attitude of the simulator, inclinometer to measure horizontality and battery sets to independently supply power only for the simulator. Finally, we present some experimental results from the application of the controller on the spacecraft simulator.

[VI-2-2] Unscented Kalman Filtering for Spacecraft Attitude and Rate Determination Using Magnetometer

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An Unscented Kalman Filter(UKF) for estimation of attitude and rate of a spacecraft using only magnetometer vector measurement is presented. The dynamics used in the filter is nonlinear rotational equation which is augmented by the quaternion kinematics to construct a process model. The filter is designed for low Earth orbit satellite, so the disturbance torques include gravity-gradient torque, magnetic disturbance torque, and aerodynamic drag. The magnetometer measurements are simulated based on time-varying position of the spacecraft. The filter has been tested not only in the standby mode but also in the detumbling mode. To stabilize the attitude, linear PD controller is applied and the actuator is assumed to be thruster. A Monte-Carlo simulation has been done to guarantee the stability of the filter performance to the various initial conditions. The UKF performance is compared to that of EKF and it reveals that UKF outperforms EKF.

[VI-2-3] Interference analysis on Japanese radio source for KOMPSAT TT&C ground system

Durk-Jong PARK and Sang-Il AHN

Korea Aerospace Research Institute

This paper presents the impact of Japanese radio source on the S-Band communication between KOMPSAT-2 satellite and TT&C ground system. Major specifications such as transmitting EIRP (Effective Isotropic Radiated Power) and location of Japanese terrestrial station were informed from Radio Research Laboratory in Korea Communication Commission. To estimate path loss in S-Band, the distance between Japanese station and TT&C ground system was obtained by using COTS (Commercial Off-The-Shelf) software. After that the signal strength of Japanese radio source placed at the TT&C ground system was calculated from link parameters such as transmitting EIRP, path loss, and receiving antenna gain. Consequently, this paper shows that the degradation caused by Japanese radio source is acceptable to TT&C ground system for satellite operation.

[VI-2-4] Study on Triaxiality Velocity of COMS induced by Wheel Off-loading

Young-Woong PARK, Dae-Kwan KIM, and Hoon-Hee LEE

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KARI (Korea Aerospace Research Institute) is going to launch a Communication, Ocean and Meteorological Satellite (COMS) at summer of 2009. It will be first thing to be developed for a geostationary satellite through domestic technology. Of course, KARI has performed this development program with EADS Astrium in France since 2005. COMS has the non-symmetric configuration that the solar array is only attached on the south panel. Due to the configuration, momentum of satellite will be rapidly accumulated induced by solar pressure and then 3 wheels of large momentum are located on roll-yaw plane for attitude control. Therefore, to prevent the saturation of wheel momentum, wheel off-loading will be performed two times per day during 10 minutes for each one. At the moment, translation movement on 3-axes direction appears because of using thrusters. In this paper, strategy of the wheel off-loading and triaxiality which is the translation effect on 3-axes are introduced. Consequently, the result of optimized triaxiality considering the wheel off-loading strategy is summarized.

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Thursday, 23 October [15:15-17:15]

[VIII-2-1] Status Report of Korean Large Telescope Project

Byeong-Gon Park, Sang Chul Kim, Young-Soo Kim, Ho-Il Kim, Hyun-Il Sung, Sang-Hyun Ahn,