I-SA03 Guidance Navigation & Control 1

09:00-11:00 **Chair : Ochi Yoshimasa (National Defense Academy)**
Room : C202 **Co-Chair : Bang Hyo Choong (KAIST)**

09:00 – 09:20 **I-SA03-1**

Stationkeeping of an Airship

Chang-Su Park, Hyo-Choong Bang, Min-Jea Tahk
(KAIST)

The airship is starting to receive new highlights as a stable floating platform. A floating platform can serve as a telecommunication relay station or an environmental outpost. Much of these operations require unmanned autonomous operation on the airship. Due to difficulties in modelling and identifying the airship, controlling the airship is not an easy task. Different from the normal aircraft, the airship is affected by ``added mass" and buoyancy. The added mass is the additional mass felt required to move the object in a fluid. As we are searching for a stable floating platform, controlling the airship to keep station is critical. We use a simple airship model with added mass for simulation. Classical controller is used to find acceptable airship performances.

09:20 – 09:40 **I-SA03-2**

Dynamic Response of An Airship at Cruising

K.Chulhwan, W. Guiaee,O. Saejong, and C. Kyumrae, L. Daewoo
(Pusan National Univ.)

The most important difference of an airship from conventional vehicle is that it has the apparent mass and inertia provided from the existence of Helium gas inside the airship. To acquire To acquire the exact response of the airship, the longitudinal responses of airship with respect to the vertical gust, which is the non-linear system, have been studied. An Airship has neutral buoyancy in equilibrium state. When it moves, its motion shows much difference comparing with conventional aircraft. Here, we compare two cases, the one has the apparent mass and the other hasn't. With the apparent mass, the magnitude of the former response is smaller than the latter, while the frequency is higher. However, the apparent mass delay ...

09:40 – 10:00 **I-SA03-3**

Longitudinal Flight Control of a Transport Aircraft Using Thrust Only

Y. Ochi and K. Kanai
(National Defense Academy)

This paper deals with a problem of decreasing the airspeed and the altitude of a transport aircraft using thrust only. Such a situation can occur, if the aircraft loses all hydraulic power that drives the control surfaces. A controller for flight path angle control is designed using the model following servo control method, which is a PI-type optimal regulator. For computer simulation, a simulation model that covers a range of flight envelope is made using given linear models and trim points at some flight conditions. Nondimensional aerodynamic coefficients, derivatives and trim points that are not at the given trim points are computed by linear interpolation. The model is effective in simulation where the trim point varies. Simulation using ...

10:00 – 10:20 **I-SA03-4**

Mixed Control with Aerodynamic Fin and Side Thruster Applied to Air Defense Missile

Chanho Song, Yoon- Sik Kim
(ADD)

This paper shows an autopilot design example with simulation results for a medium range surface-to-air missile used to intercept fast maneuver targets. The missile is assumed to use both aerodynamic fins and side thrusters to achieve fast time response. The steady-state maneuver capability of the missile is assumed to be enough at high altitude to engage usual maneuvering targets. Side thruster is used to get an extremely rapid acceleration response at high altitude where the missile's aerodynamic control effectiveness is weak. The strategy of control design is firstly to employ side thrusters to achieve a rapid response and then to hand-over the control to the aerodynamic fins to maintain the desired acceleration command in the steady state...

10:20 – 10:40 **I-SA03-5**

An Adaptive Flight Control Law Design for the ALFLEX Flight Control System

Kanta Imai, Yuzo Shimada, and Kenji Uchiyama
(Nihon Univ.)

In this report, an adaptive flight control law based on a linear-parameter-varying (LPV) model is presented for a flight control system. The control system is designed to track an output of a vehicle to a reference signal from the guidance system, which generates a reference flight path. The proposed adaptive control law adjusts the controller gains continuously on line as flight conditions change. The obtained adaptive controller guarantees global stability over a wide flight envelope. Computer simulation involving six-degree-of-freedom nonlinear flight dynamics is applied to Japan's automatic landing flight experimental vehicle (ALFLEX) to examine the effectiveness of the proposed adaptive flight control law.