

Labs for Flight System and Control System

Staff	Yoriaki Baba (Professor) Hiroyuki Takano (Associate Professor) Takeshi Yamasaki (Research Associate)	Masaaki Murata (Professor)
Graduate Student	Keisuke Enomoto (D1) Hirotoshi Sakaida (M2) Hideyo Osuga (M2) Shinji Fukui (M1)	Takahiro Yoshioka (M1)
Graduate Trainee	Makoto Maehokama	Toru Yamamoto Ryuji Majima

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Research Fields in Baba Lab

- Missile Guidance
- Trajectory Optimization for Aircraft and Spacecraft
- Guidance and Control System for Unmanned Aerial Vehicle (UAV)
- Aircraft Handling Quality

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Research Topics, example #1: Missile Guidance

Study on Tactical Missile Guidance

Modification of a tactical missile guidance law and its evaluation conducted by way of computer simulations



Fig. 1 Launched Surface-to-Air Missile

Research Topics, example #2: Trajectory Optimization

Trajectory Optimization for Aircraft and Spacecraft

- Research on the trajectory solution of a minimum time problem, such as minimum time turns or vertical loops etc. for high performance aircraft, under some state constraints
- Research and development on schemes to solve an optimal problem for Spacecraft trajectories and satellite orbit transfers

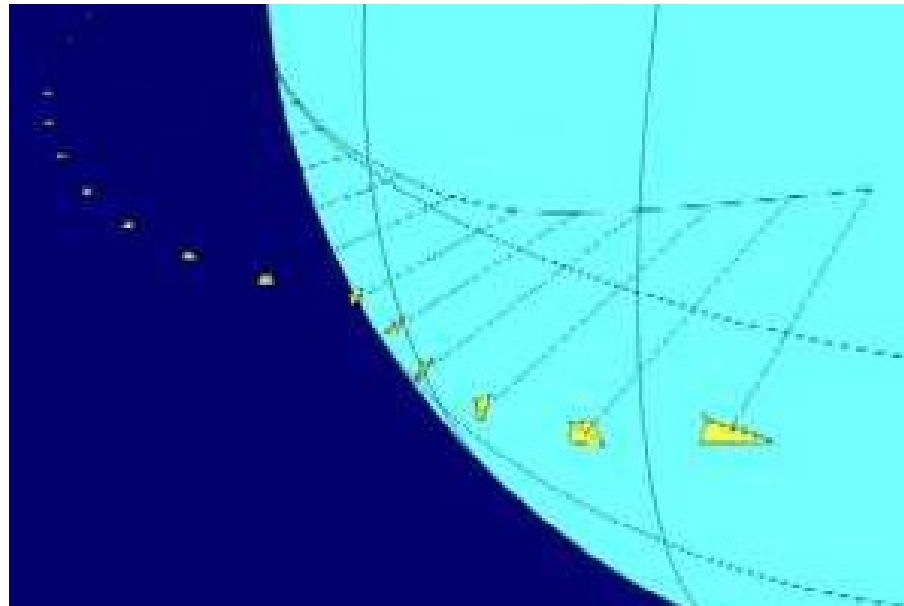


Fig. 2 Example of the optimal re-entry flight for a space vehicle

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Research Topics, example #3: Guidance and Control System for Unmanned Aerial Vehicle

Guidance and Control System Design for UAV

- Guidance and control system design for terrain following, path-following, leader-following UAV
- Development and evaluation of automatic dog-fight laws for Unmanned Combat Aerial Vehicle (UCAV) using computer simulations

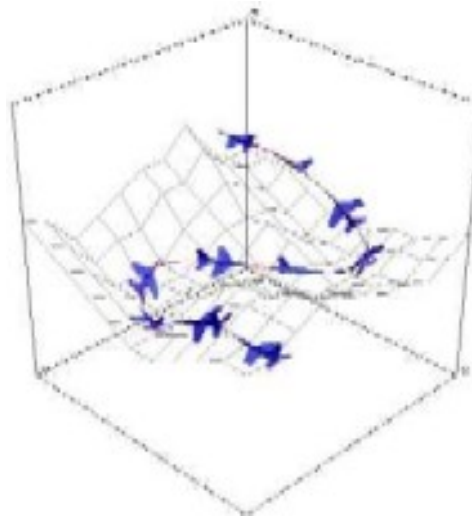


Fig. 3 Flight simulation of a terrain-following UAV

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Research achievement by graduate students in 2007

- (1) K. Enomoto, T. Yamasaki, H. Takano, Y. Baba:
“Guidance and Control System Design Using a Dynamic inversion method for Automatic following Aircraft,”
The 38th JSASS Annual Conference (Tokyo, Japan), pp.191-194(Apr. 2007)
- (2) K. Enomoto, T. Yamasaki, H. Takano, Y. Baba:
“Automatic Following for UAVs Using Dynamic Inversion,”
SICE Annual Conference 2007(Takamatsu), CD-ROM, 3A14-2 (Sep. 2007)
- (3) M. Nawa, H. Takano, T. Yamasaki, and Y. Baba:
“Minimum Time Vertical Turn of a Helicopter,”
SICE Annual Conference 2007(Takamatsu), CD-ROM, 3B14-1 (Sep. 2007)
- (4) M. Nawa, H. Takano, T. Yamasaki, and Y. Baba:
“Minimum Time 3 Dimensional Turn of a Helicopter,”
2007 JSASS-KSAS Joint International Symposium CJSASS (Fukuoka, Japan),
CD-ROM, 027, pp. 108-111 (Oct. 2007)
- (5) K. Enomoto, T. Yamasaki, H. Takano, and Y. Baba:
“Automatic Following System Design for UAVs Using Potential Energy for a Velocity Controller,”
2007 JSASS-KSAS Joint International Symposium CJSASS (Fukuoka, Japan), CD-ROM, 100, pp. 400-403 (Oct. 2007)
- (6) K. Enomoto, T. Yamasaki, H. Takano, Y. Baba:
“Velocity Control System Design for Follower UAV,”
The 50th Automatic Control Conference (Kanagawa, Japan), CD-ROM, 325, pp. 675-680 (Nov. 2007)

Research Fields in Murata Lab

- Orbital Mechanics
- Astronautics and Aerospace Navigation (GPS Applications)
- Satellite Utilizations
- Satellite Geodesy
- Precision Orbit Determination
- Mission Plan and Flight Analysis

Murata lab

Research topics, example #1: GPS Applications

- PPP (Precise Point Positioning) for land and aerial users of the GPS
- Design and performance evaluation of MEMS IMU/GPS

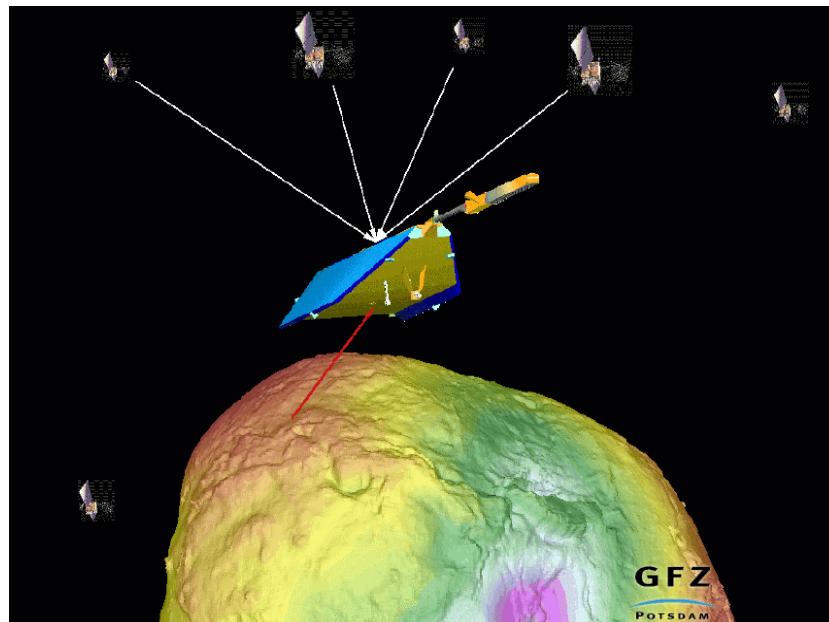


Fig. 4 Helicopter flight experiment in November 2006.

Murata lab

Research topics, example #2: Spacecraft Navigation and Orbit Estimation

- Navigation and orbit determination (including PPP) for LEO, GEO, and HEO user satellites from GPS tracking data and others
- Advanced navigation filter design for spacecraft, in particular, using the unscented Kalman filter (UKF) method
- Plan and feasibility analysis for next-generation satellite missions



(by courtesy of GFZ)

Fig.5 Artist conception of German satellite CHAMP executing on-orbit navigation with GPS. Both GPS and satellite laser ranging (SLR) (shown with red line) are the basis for precise orbit determination (POD) to support the CHAMP science missions.

Murata lab

Research achievement by graduate students in 2007

- (1) M.Honda, M.Murata, and Y.Mizukura:
“Development and Assessment of GPS Precise Point Positioning Software for Land Vehicular Navigation”,
SICE e-Journal, Vol.6, No.10, pp.78-84 (2007.6)
- (2) Y.Shimizu and M.Murata:
“Flight Evaluation of GPS Precise Point Positioning Software for Helicopter Navigation”, SICE Journal of Control, Measurement, and System Integration (JCMSI), Vol.1, No.5, pp.1-6 (2008.9)
(Also, see Proc. of SICE Annual Conference 2007 (CD-ROM), Takamatsu, pp.3013-3018 (2007.9))
- (3) Y.Shimizu and M.Murata:
“Several Trials for Improving PPP Performance of Helicopter Navigation”,
Proc. of 24th Guidance and Control Symposium, Nagano, pp.55-62 (2007.10).