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Mechanical and Aerospace Engineering
Naval Postgraduate School
236A Watkins Hall, 833 Dyer Rd, Monterey
CA 93943, USA

• **Education**

- | | |
|--|---|
| <p>Ph.D. University of Michigan
Aerospace Engineering
Thesis: Real-time prediction control of constrained nonlinear systems using the IPA-SQP approach
Advisors: Jing Sun and Ilya Kolmanovsky
Committee: James Cutler and James Freudenberg</p> <p>M.S. Seoul National University
Aerospace Engineering
Thesis: Development of a prototype nanosatellite, SNUBYUL-I
Advisor: In-Seuck Jeung
Committee: Yudan Kim and Chan-Gook Park</p> <p>B.S. Seoul National University
Mechanical and Aerospace Engineering</p> | <p>Ann Arbor, MI, USA
Sept. 2009 – May 2014</p> <p>Seoul, Republic of Korea
Sept. 2005 – Feb. 2008</p> <p>Seoul, Republic of Korea
March 1999 – Feb. 2003</p> |
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• **Research Interests**

Real-time nonlinear model predictive control (MPC)

- Analysis and experimentation on nonlinear MPC controllers for constrained nonlinear systems - spacecraft, unmanned aerial vehicles (UAV), electrified vehicles

Guidance and control of spacecraft rendezvous and docking/proximity maneuvers

- Development of guidance and control methodologies for spacecraft relative motion control such as rendezvous and docking, debris/obstacle avoidance maneuvers, and formation flying

Guidance and control of autonomous UAVs with robotic manipulation capability

- Development of guidance and control methodologies for robust and stable maneuvering of multicopters with aerial manipulation capability to contact the environment

Hardware-in-the-loop (HIL) simulations

- Real-time embedded controllers (experiences on Opal-RT simulators and Real-Time Workshop)

Fast numerical optimization methods and algorithms

- Development of computational methods on optimization-based control for nonlinear systems

• **Professional Experience**

Postdoctoral Research Associate	Naval Postgraduate School Department of Mechanical and Aerospace Engineering Spacecraft Robotics Laboratory <ul style="list-style-type: none"> - Guidance and control for aerial manipulation using a multicopter with a robotic arm - Real-time model predictive control of spacecraft robots floating on a granite table Advisor: Marcello Romano	Monterey, CA May 2015 –Present
Postdoctoral Researcher	University of Michigan Department of Aerospace Engineering <ul style="list-style-type: none"> - Development of a software for the integrated perturbation analysis and sequential quadratic programming (IPA-SQP) for aerospace applications - Launch trajectory optimization Advisor: Ilya Kolmanovsky	Ann Arbor, MI July 2014 –April 2015
Research Assistant	University of Michigan Department of Aerospace Engineering, Department of Naval Architecture and Marine Engineering <ul style="list-style-type: none"> - Spacecraft rendezvous and docking and for debris/obstacle avoidance using a linear quadratic MPC approach and the nonlinear solver IPA-SQP - Real-time nonlinear MPC for shipboard power and energy management - Developing methodologies for adaptive MPC and time-optimal MPC using the IPA-SQP algorithm Advisor: Jing Sun and Ilya Kolmanovsky	Ann Arbor, MI Sep. 2010 –April 2014
Intern	Ford Motor Company Research & Advanced Engineering Research & Innovation Center, Dearborn, MI, USA <ul style="list-style-type: none"> - Development of algorithms for solving parametric root finding/optimization problems of multi-variables for rapid engine mapping Supervisor: Dimitar Filev	Dearborn, MI May 2011 – Aug. 2011
Associate Engineer	Samsung Engineering Co. Ltd. Mechanical engineering department <ul style="list-style-type: none"> - Technical evaluation of rotating machinery for constructing industrial factories 	Seoul, Korea Jan. 2008 – July 2009
First lieutenant/ Platoon Leader	Republic of Korea Marine Corps Infantry officer <ul style="list-style-type: none"> - Managing and training a marine platoon for infantry tactical tasks and amphibious operations 	Pohang, Korea March 2003 – Feb. 2005

- **Academic Honors**

Postdoctoral Research Associateship, U.S. National Research Council Research Associateship Program, 2015, 2016	May 2015 – Present
Best Paper Award 6 th International Conference of Astrodynamics Tools and Techniques (ICATT) Darmstadt, Germany	March 2016
Second Placed Winner, Representative of Seoul National University 9 th ARLISS Competition, Blackrock desert, NV, USA	Sep. 2007
Third Placed Winner, Representative of Seoul National University 11 th International Design Contest ROBOCON, Seoul, Korea, 2000	Aug. 2000
Research Aid Fund, Brain Korea 21 program Visiting Student, University of Tokyo, - Design of a nano-satellites as a tool of energy transfer research in space - Korea-Japan international collaborative research program Advisor: Shinich Nakasuka	Apr. 2006 – Aug. 2006
Undergraduate Scholarship Department of Mechanical and Aerospace Engineering, Seoul National University	1999 – 2003

- **Publications**

Ph.D. Thesis

H. Park. Real-time predictive control of constrained nonlinear systems using the IPA-SQP approach. University of Michigan, 2014.

Master's Thesis

H. Park. Development of a prototype nano-satellite, SNUBYUL-I (in Korean). Seoul National University, 2007.

Journal Articles

1. H. Park, J. Sun, S. Pekarek, P. Stone, D. Opila, R. Meyer, I. Kolmanovsky, and R. DeCarlo, Real-time model predictive control for shipboard power management using the IPA-SQP approach. *IEEE Transactions on Control Systems Technology*, 2015.
2. S. Di Cairano, H. Park, and I. Kolmanovsky. Model predictive control approach for guidance of spacecraft rendezvous and proximity maneuvering. *International Journal of Robust and Nonlinear Control*, vol. 12, No. 4, pp. 1398 – 1427, 2012.

Conference Proceedings

1. J. Virgili-Llop, C. Zagaris, H. Park, R. Zappulla, and M. Romano. Experimental evaluation of model predictive control and inverse dynamics control for spacecraft proximity and docking maneuvers. *6th International Conference on Astrodynamics Tools and Techniques*, 2016, *Best Paper Award*.
2. R. Zappulla, H. Park, J. Virgili-Llop, and M. Romano. Experiments on autonomous spacecraft rendezvous and docking using an adaptive artificial potential field approach. *26th AAS/AIAA Space Flight Mechanics Meeting*, 2016.
3. D. Lee, H. Park, and J. Cutler. Development of CubeSat attitude determination and control system with a hybrid control strategy and its simulator on SO(3). *26th AAS/AIAA Space Flight Mechanics Meeting*, 2016.
4. E. Capello, H. Park, B. Tavora, G. Guglieri, and M. Romano. Modeling and experimental parameter identification of a multicopter via a compound pendulum test rig. *3rd IEEE Robotics & Automation Society Workshop on Research, Education, and Development of Unmanned Aerial Systems (RED-UAS)*, 2015.
5. H. Park, R. Gupta, E. Dai, J. McCallum, G. Pietron, M. Shelton, and I. Kolmanovsky. Quantifying performance of a connected vehicle by optimal control. *4th IFAC Workshop on Engine and Powertrain Control, Simulation, and Modeling (E-COSM)*, 2015.
6. P. Stone, D. Opila, H. Park, J. Sun, S. Pekarek, R. DeCarlo, E. Westervelt, J. Brooks, and G. Seenumani. Shipboard power management using constrained nonlinear model predictive control. *IEEE Electric Ship Technologies Symposium*, 2015.
7. H. Park, J. Sun, and I. Kolmanovsky. Tutorial overview of integrated perturbation analysis – sequential quadratic programming approach. *11th World Congress on Intelligent Control and Automation*. Invited sessions, 2015.
8. R. Meyer, S. Pekarek, H. Park, J. Sun, and R. DeCarlo, Hybrid optimal power management of a ship. *ASME International Mechanical Engineering Congress & Exposition*, 2014.
9. H. Park, I. Kolmanovsky, and J. Sun. Parametric integrated perturbation analysis - sequential quadratic programming approach for minimum-time model predictive control. *IFAC 19th World Congress*, 2014.
10. J. Sun, H. Park, I. Kolmanovsky, and R. Choroszuca. Adaptive model predictive control in the IPA-SQP framework. *52nd IEEE Conference on Decision and Control*, 2013.
11. H. Park, I. Kolmanovsky, and J. Sun. Model predictive control of spacecraft relative motion maneuvers using the IPA-SQP approach. *ASME Dynamics Systems and Control Conference*, 2013.
12. H. Park, S. Di Cairano, and I. Kolmanovsky. Linear quadratic model predictive control approach to spacecraft rendezvous and docking. *21st AAS/AIAA Space Flight Mechanics Meeting*, 2011.
13. H. Park, S. Di Cairano, and I. Kolmanovsky. Model predictive control for spacecraft rendezvous and docking with a rotating/tumbling platform and for debris avoidance. *American Control Conference*, 2011.

14. H. Park, S. Di Cairano, and I. Kolmanovsky. Model predictive control of spacecraft docking with a non-rotating platform. *IFAC 18th World Congress*, 2011.
15. C. Ahn, H. Park, J. Moon, S. Kim, I. Jeung, and Y. Kim. Guidance and control system development of CANSAT (in Korean). *Conference Korean Society for Aeronautical and Space Science*, South Korea, 2006.
16. J. Moon, H. Park, C. Ahn, S. Kim, I. Jeung, and Y. Kim. Development of a nano-satellite, CANSAT (in Korean). *Korean Society for Aeronautical and Space Science Fall Conference*, South Korea, 2006.

- **Technical Presentations**

1. Remote control of a multicopter UAV with manipulation capability, Presented at *Plenary Session and Poster Session, Naval Research Program – Naval Research Working Group 16*, Naval Postgraduate School, Monterey, CA, 2016
2. Project Manicopter: Multicopter-based robotic arm for aerial manipulation, Presented at *Consortium for Robotics and Unmanned Systems Education and Research (CRUSER)*, Naval Postgraduate School, Monterey, CA, 2016
3. Real-time predictive control using the IPA-SQP approach and its applications in space. Presented at *Aerospace Engineering Seminar*, Seoul National University, Seoul, Republic of Korea, 2014
4. Model predictive control of spacecraft relative motion maneuvers using the IPA-SQP approach. Presented at *Engineering Graduate Symposium*, University of Michigan, Ann Arbor, MI, 2013
5. Model predictive control for rendezvous and docking of spacecraft and for debris avoidance maneuvers. Presented at *Flight Dynamics and Control Student Seminar Series*, Department of Aerospace Engineering, University of Michigan, Ann Arbor, MI, 2010.

- **Professional Activities and Service**

Member, Institute of Electrical and Electronics Engineers (IEEE)

Member, American Institute of Aeronautics and Astronautics (AIAA)

Member, American Society of Mechanical Engineers (ASME)

Review Editor in Space Robotics, *Frontiers in Astronomy and Space Sciences* and Robotics and AI
Publication Reviewer for

Journals

- IEEE Transaction on Control Systems Technology
- International Journal of Robust and Nonlinear Control
- International Journal of Adaptive Control and Signal Processing
- Advances in Space Research
- Acta Astronautica
- Journal of Intelligent and Robotics Systems

Conference Proceedings

- IEEE Conference on Decision and Control (CDC)
- IEEE American Control Conference (ACC)
- International Federation of Automatic Control (IFAC) World Congress
- Indian Control Conference (ICC)
- International Conference on Unmanned Aircraft Systems (ICUAS)

- **References**

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