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## Resume of Hyeongjun Park, 2018

Park, Hyeongjun

Monterey, California: Naval Postgraduate School

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• **Education**

- Ph.D. University of Michigan** Ann Arbor, MI, USA  
Aerospace Engineering Sept. 2009 – May 2014  
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
- M.S. Seoul National University** Seoul, Republic of Korea  
Aerospace Engineering Sept. 2005 – Feb. 2008  
Thesis: Development of a prototype nanosatellite, SNUBYUL-I  
Advisor: In-Seuck Jeung  
Committee: Yudan Kim and Chan-Gook Park
- B.S. Seoul National University** Seoul, Republic of Korea  
Mechanical and Aerospace Engineering March 1999 – Feb. 2003

• **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**

<b>Postdoctoral Research Associate</b>	<b>Naval Postgraduate School</b> Department of Mechanical and Aerospace Engineering Spacecraft Robotics Laboratory <ul style="list-style-type: none"> <li>- Guidance and control for aerial manipulation using a multicopter with a robotic arm</li> <li>- Real-time model predictive control of spacecraft robots floating on a granite table</li> </ul> Advisor: Marcello Romano	Monterey, CA May 2015 –Present
<b>Postdoctoral Researcher</b>	<b>University of Michigan</b> Department of Aerospace Engineering <ul style="list-style-type: none"> <li>- Development of a software for the integrated perturbation analysis and sequential quadratic programming (IPA-SQP) for aerospace applications</li> <li>- Launch trajectory optimization</li> </ul> Advisor: Ilya Kolmanovsky	Ann Arbor, MI July 2014 –April 2015
<b>Research Assistant</b>	<b>University of Michigan</b> Department of Aerospace Engineering, Department of Naval Architecture and Marine Engineering <ul style="list-style-type: none"> <li>- Spacecraft rendezvous and docking and for debris/obstacle avoidance using a linear quadratic MPC approach and the nonlinear solver IPA-SQP</li> <li>- Real-time nonlinear MPC for shipboard power and energy management</li> <li>- Developing methodologies for adaptive MPC and time-optimal MPC using the IPA-SQP algorithm</li> </ul> Advisor: Jing Sun and Ilya Kolmanovsky	Ann Arbor, MI Sep. 2010 –April 2014
<b>Intern</b>	<b>Ford Motor Company</b> Research & Advanced Engineering Research & Innovation Center, Dearborn, MI, USA <ul style="list-style-type: none"> <li>- Development of algorithms for solving parametric root finding/optimization problems of multi-variables for rapid engine mapping</li> </ul> Supervisor: Dimitar Filev	Dearborn, MI May 2011 – Aug. 2011
<b>Associate Engineer</b>	<b>Samsung Engineering Co. Ltd.</b> Mechanical engineering department <ul style="list-style-type: none"> <li>- Technical evaluation of rotating machinery for constructing industrial factories</li> </ul>	Seoul, Korea Jan. 2008 – July 2009
<b>First lieutenant/ Platoon Leader</b>	<b>Republic of Korea Marine Corps</b> Infantry officer <ul style="list-style-type: none"> <li>- Managing and training a marine platoon for infantry tactical tasks and amphibious operations</li> </ul>	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 <sup>th</sup> International Conference of Astrodynamics Tools and Techniques (ICATT) Darmstadt, Germany	March 2016
Second Placed Winner, Representative of Seoul National University 9 <sup>th</sup> ARLISS Competition, Blackrock desert, NV, USA	Sep. 2007
Third Placed Winner, Representative of Seoul National University 11 <sup>th</sup> 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. *6<sup>th</sup> 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. *26<sup>th</sup> 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). *26<sup>th</sup> 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. *3<sup>rd</sup> 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. *4<sup>th</sup> 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. *11<sup>th</sup> 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 19<sup>th</sup> World Congress*, 2014.
10. J. Sun, H. Park, I. Kolmanovsky, and R. Choroszuca. Adaptive model predictive control in the IPA-SQP framework. *52<sup>nd</sup> 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. *21<sup>st</sup> 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 18<sup>th</sup> 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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**Jing Sun**, *Professor*, Department of Naval Architecture and Marine Engineering/ Department of  
Electrical Engineering and Computer Science, University of Michigan  
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