

## CONTACT INFORMATION

Room 501, Information Technology Building  
School of Electrical and Computer Engineering  
University of Seoul (UOS)  
163 Seoulsiripdaero, Dongdaemun-gu  
Seoul, 02504, South Korea  
Lab: Decision and Control Systems Laboratory  
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## AREAS OF EXPERTISE

- ◇ (Deep) Reinforcement Learning and Markov Decision Processes
- ◇ Control of Unmanned Vehicle Systems
- ◇ Stochastic Optimal Control and Estimation
- ◇ Game Theory and Learning, (Finite and Infinite-Dimensional) Optimization Theory
- ◇ Applied Probability Theory and Functional Analysis
- ◇ Radar Systems and Target Tracking Applications

## EDUCATION

**University of Illinois at Urbana-Champaign**, Urbana, Illinois, USA Dec. 2015

*Ph.D. in Electrical and Computer Engineering*

Adviser: Professor Tamer Başar

Thesis: *Control and Estimation with Limited Information: A Game-Theoretic Approach*

**Hanyang University**, Seoul, South Korea Feb. 2008

*M.S. in Electrical Engineering*

Adviser: Professor Chung Choo Chung

Thesis: *Design of Robust Disturbance Observer Controller for SPM-based Data Storage System*

**Hanyang University**, Seoul, South Korea Feb. 2006

*B.S. in Electrical and Computer Engineering*

## WORKING EXPERIENCE

**University of Seoul**, Seoul, South Korea March. 2019 - Present

*Assistant Professor, School of Electrical and Computer Engineering*

**Ulsan National Institute of Science and Technology**, South Korea Feb. 2016 - Feb. 2019

*Assistant Professor, School of Electrical and Computer Engineering*

**Ulsan National Institute of Science and Technology**, South Korea Nov. 2015 - Feb. 2016

*Visiting Assistant Professor, School of Electrical and Computer Engineering*

- Appointed before receiving the Ph.D. degree

**Agency for Defense Development (ADD)**, South Korea Feb. 2008 - June 2011

*Researcher, Radar Group, Remote Sensing Division*

- Project Title: Multi-Function Radar (MFR), *Cheon-goong*, Korean Middle-Range Surface to Air Missile Defense System

**Military Service**, 22th Army Division, South Korea

July 2000 - Sep. 2002

#### RESEARCH EXPERIENCE

**University of Illinois at Urbana-Champaign**, Illinois, USA

Aug. 2011 - Dec. 2015

*Graduate Research Assistant, Decision and Control, Coordinated Science Laboratory*

- Stochastic optimal control and estimation with limited information
- Large-scale distributed optimization via mean field game theory

**Hanyang University, Seoul, South Korea**

Feb. 2006 - Feb. 2008

*Graduate Research Assistant, Systems and Control Laboratory*

- Project: Control systems for scanning probe data storage systems

#### TEACHING EXPERIENCE

**University of Seoul**, Seoul, South Korea

March. 2019 - Present

- Spring 2019
  - Electrical Engineering Experiment
  - Microprocessor

**Ulsan National Institute of Science and Technology**, South Korea

Feb. 2016 - Feb. 2019

- Fall 2018
  - Control Engineering (ECE313, undergraduate)
- Spring 2018
  - Digital Logic Design (CSE201, undergraduate)
  - Linear and Robust Control Theory (ECE542, graduate)
- Fall 2017
  - Control Engineering (ECE313, undergraduate)
  - Special Topic: Random Processes and Markov Chains (ECE630, graduate)
- Spring 2017
  - Digital Logic Design (CSE201, undergraduate)
  - Calculus of Variations and Optimal Control Theory (ECE733, graduate)
- Fall 2016
  - Control Engineering (ECE313, undergraduate)
  - Introduction to Optimization: Convex Optimization (ECE506, graduate)
- Spring 2016
  - Digital Logic Design (CSE201, undergraduate)
  - Linear System Theory (ECE542, graduate)

**University of Illinois at Urbana-Champaign**, Illinois, USA Jan. 2015 - May 2015

- *Teaching Assistant: Optimization by Vector Space Methods (ECE580)*
- Instructor: Professor Tamer Başar

**Hanyang University**, Seoul, South Korea Mar. 2006 - July 2006

- *Teaching Assistant: Control Engineering (undergraduate)*
- Instructor: Professor Chung Choo Chung

### Research Grants

- Development of Joint Electrical/Mechanical Drone Beamforming based on Target Detection and Precise Attitude Control, Institute for Information & communications Technology Promotion (IITP, July 2018 - Dec. 2022): Co-Principal Investigator **₩1,000,000K**
- Infinite-Dimensional Stochastic Optimization Theory and Algorithm (NRF, Sep. 2017 - Feb. 2021): Principal Investigator, **₩160,000K**
- Research Center for Aircraft Core Technology, Engineering Research Center (ERC) (Gyeongsang National University, NRF, Jun. 2017 - Feb. 2024): Core Researcher, **₩20,135,000K**
- Optimal Distributed Control of Unmanned Vehicle Groups (Lockheed Martin, USA, Nov. 2016 - July. 2018): Principal Investigator, **\$95,000**
- Mean Field Games for Large-Scale Distributed Systems (NRF, June 2016 - June 2018): Principal Investigator, **₩100,000K**
- Large-Scale Optimization for Multi-agent Systems (UNIST, March 2016 - Aug. 2017): Principal Investigator, **₩30,000K**

### HONORS AND AWARDS

- IEEE CDC 2015 Student and Young Researcher Travelling Award Dec. 2015
- Fellowship, University of Illinois, Urbana-Champaign, Illinois, USA Aug. 2011 - Aug. 2013
- Fulbright Graduate Study Award, USA Aug. 2011
- Agency for Defense Development Scholarship, South Korea Feb. 2006 - Feb. 2008
- Science and Technology Fellowship, Hanyang University, Korea Feb. 2006 - Feb. 2008
- Honor Scholarship, Hanyang University, South Korea 2003 - 2004

### SERVICES

- UNIST
  - ECE Lab Space Committee (March 2018 - Present)
  - ECE Education Committee (Sep. 2016 - Feb. 2018)
  - ECE Lab Introduction Committee (March 2016 - Feb. 2018)
- Conferences
  - The 8th IFAC Workshop on Distributed Estimation and Control in Networked Systems (NecSys 2019), International Program Committee (IPC)
  - 2019 ICROS

- 2019 The 19th International Conference on Control, Automation and Systems (ICCAS 2019), Exhibition Co-Chairs
- 2018 The 18th International Conference on Control, Automation and Systems (ICCAS 2018), International Program Committee
- 2018 Conference on Decision and Game Theory for Security (2018 GameSec), Asia Publicity Chair
- The 3rd International Conference on Consumer Electronics (ICCE) Asia 2018, Invited Session Organizer (Session Title: Control and its Applications)
- The 2019 17th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt'18): Technical Program Committee
- The 2018 16th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt'18): Technical Program Committee
- Conference Session Chairs: CDC (2015, 2018), ICCAS (2016), ICROS (2017)
- Member
  - IEEE Control Systems Society, Institute of Control, Robotics and Systems, The Korean Society for Aeronautical and Space Sciences
- Reviewer
  - *Automatica*, SIAM Journal on Control and Optimization, IEEE Transactions on Control of Network Systems, IEEE Transactions on Automatic Control, International Journal of Robust and Nonlinear Control, IEEE Journal on Selected Areas in Communications, IET Control Theory and Applications, IEEE Transactions on Circuits and Systems II, International Journal of Control, Automation and Systems, IEEE/ACM Transactions on Networking, Games, Mathematics and Computers in Simulation, IEEE Transactions on Vehicular Technology
- Reviewer (Conferences)
  - American Control Conference, IEEE Conference on Decision and Control, IFAC World Congress, IFAC Workshop on Distributed Estimation and Control in Networked Systems, European Control Conference

## INVITED TALKS AND TUTORIALS

- Control and Estimation with Limited Information: A Game-Theoretic Approach (Jan. 2019): Hanyang University, South Korea
- Control and Estimation with Limited Information: A Game-Theoretic Approach (Dec. 2018): University of Seoul, South Korea
- Control and Estimation with Limited Information: A Game-Theoretic Approach (Sep. 2018): Postech, South Korea
- Risk-Sensitive Zero-Sum Differential Games (July, 2018): 2018 Japan-Korea Control Theory & Technology Workshop, South Korea
- Risk-Sensitive Mean Field Games via the Stochastic Maximum Principle (July, 2018): 18th International Symposium on Dynamic Games and Applications, France
- Risk-Sensitive Mean Field Games with Applications to Unmanned Systems (June, 2018): The Third International Conference On Consumer Electronics Asia (ICCE-Asia 2018), South Korea

- Control and Estimation with Limited Information: A Game-Theoretic Approach (Jan. 2018): KAIST, South Korea
- Distributed Convex Optimization (Nov. 2017): The 9th Asian Conference on Machine Learning (ACML 2017), Tutorial, South Korea
- Control and Estimation with Limited Information: A Game-Theoretic Approach (Aug. 2017): KAIST, South Korea
- Two Counterexamples in Optimal Control Theory (May, 2017): ICROS 2017, South Korea
- Machine Learning with Sequential Data (Oct. 2016): The 16th International Conference on Control, Automation and Systems (ICCAS 2016), Tutorial, South Korea (with Prof. Jaesik Choi (UNIST))
- Robust Control and Estimation over Unreliable Communication Channels (Oct. 2016): KITECH, South Korea
- Risk-Sensitive Mean Field Games (Sep. 2016): ICROS, Technical Committee on Control Theory, Seoul National University, South Korea
- Reinforcement Learning (July, 2016): Hanyang University Autonomous Driving Systems Workshop, Jeju Island, South Korea
- Control and Estimation with Limited Information: A Game-Theoretic Approach (March, 2016): Seoul National University, South Korea
- Control and Estimation with Limited Information: A Game-Theoretic Approach (March, 2016): Hanyang University, South Korea
- Control and Its Applications (Dec. 2015): ECE, UNIST, South Korea
- Control and Estimation with Limited Information: A Game-Theoretic Approach (Sep. 2015): UNIST, South Korea

#### STUDENTS AND POSTDOCS

- Myoung Hoon Lee (March 2016 - Present): MS-PhD combined student, UNIST
- Ngo-Phong Nguyen: PhD student (March 2018 - Present), Researcher (Dec. 2017 - Feb. 2018)
- Alisher Abdulov (Sep. 2017 - Present): MS student, UNIST
- Dr. Youngwoo Lee (Feb. 2017 - Feb. 2018): UNIST Research Scientist, Postdoc, UNIST, Visiting Scholar, UC Berkeley
- Woo-Hyun Kim, Researcher (Sep. 2017 - Dec. 2017)
- Undergraduate Researchers: Do Hyun Kwon, Tae Hoon Lee, Hee Yong Kwon

#### Publications

**Journal Papers (published and accepted) (\*: Corresponding author)**

1. **Jun Moon\*** and Tamer Başar, "Risk-Sensitive Mean Field Games via the Stochastic Maximum Principle," *Dynamic Games and Applications*, accepted, 2018 (**SCI, IF:1.647**).
2. **Jun Moon\***, "A Sufficient Condition for Linear-Quadratic Stochastic Zero-Sum Differential Games for Markov Jump Systems," *IEEE Transactions on Automatic Control*, accepted, 2018 (**SCI, IF:4.270, Top 10%**).

3. Jun Moon\*, Tyrone E. Duncan, and Tamer Başar, “Risk-Sensitive Zero-Sum Differential Games,” *IEEE Transactions on Automatic Control*, accepted, 2018 (SCI, IF:4.270, Top 10%).
4. Jun Moon\* and Tamer Başar, “Linear Quadratic Mean Field Stackelberg Differential Games,” *Automatica*, vol. 97, pp. 200-213, Nov. 2018 (SCI, IF:5.451, Top 5%).
5. Jun Moon\* and Tamer Başar, “Static Optimal Sensor Selection via Linear Integer Programming: the Orthogonal Case,” *IEEE Transactions on Signal Processing Letters*, vol. 24, no. 7, pp. 953-957, 2017 (SCI, IF:2.528).
6. Jun Moon\* and Tamer Başar, “Linear Quadratic Risk-Sensitive and Robust Mean Field Games,” *IEEE Transactions on Automatic Control*, vol. 62, no. 3, pp. 1062-1077, 2017 (SCI, IF:4.270, Top 10%).
7. Jun Moon\* and Tamer Başar, “Risk-Sensitive Control of Markov Jump Linear Systems: Caveats and Difficulties,” *International Journal of Control, Automation and Systems*, vol. 15, no. 1, pp. 462-467, 2017 (SCI, IF:1.687).
8. Jun Moon\* and Tamer Başar, “Robust Mean Field Games for Coupled Markov Jump Linear Systems,” *International Journal of Control*, vol. 89, issue 7, pp. 1367-1381, 2016 (SCI, IF:2.208).
9. Jun Moon\* and Tamer Başar, “Minimax Estimation with Intermittent Observations,” *Automatica*, vol. 62, pp. 122-133, Dec. 2015 (SCI, IF:5.451, Top 5%).
10. Jun Moon\* and Tamer Başar, “Minimax Control over Unreliable Communication Channels,” *Automatica*, vol. 59, pp. 182-193, Sep. 2015 (SCI, IF:5.451, Top 5%).

**Journal Papers (under review and conditionally accepted) (\*: Corresponding author)**

1. Myoung Hoon Lee and Jun Moon\*, “Necessary and Sufficient Conditions of Risk-Sensitive Optimal Control and Differential Games for Stochastic Differential Delayed Equations,” *International Journal of Robust and Nonlinear Control*, submitted (under review).
2. Ngo Phong Nguyen, Wonhee Kim and Jun Moon\*, “Super-Twisting Observer-based Sliding Mode Control with Fuzzy Variable Gains and Its Application to Control and Fault Estimation of Fully-Actuated Hexarotors,” *Journal of Franklin Institute*, submitted (under review), 2018.
3. Jun Moon\*, “The Risk-Sensitive Maximum Principle for Controlled Forward-Backward Stochastic Differential Equations,” *Automatica*, submitted, 2018 (under review) (SCI, IF:5.451, Top 5%).
4. Myoung Hoon Lee and Jun Moon\*, “Partially-Observed Decentralized Optimal Control for Large Population Two-Wheeled Vehicles: A Differential Game Approach,” *IEEE Transactions on Cybernetics*, 2018 (under review) (SCI, IF:7.384, Top 5%).
5. Myoung Hoon Lee, Ngo Phong Nguyen and Jun Moon\*, “Leader-Follower Decentralized Optimal Control for Large Population Hexarotors with Tilted Propellers: A Stackelberg Game Approach,” *Journal of Franklin Institute*, 2018 (under review).
6. Youngwoo Lee, Liting Sun, Jun Moon\*, Chung Choo Chung, and Masayoshi Tomizuka, “Reference Modulation for Performance Enhancement of a Class of Motion Control Systems with Nonlinear Parameter Variations,” *IEEE/ASME Transactions on Mechatronics*, submitted 2018 (under review) (SCI, IF:4.357, Top 5%).
7. Jun Moon\* and Yoonsoo Kim, “Linear-Exponential-Quadratic Gaussian Control for Mean Field Stochastic Systems,” *IEEE Transactions on Automatic Control*, submitted (under review).

8. Ngo Phong Nguyen and **Jun Moon\***, “Linear-Quadratic Mean Field Stochastic Zero-Sum Differential Games,” *Automatica*, submitted (under review)
9. Jun Moon, Generalized Risk-Sensitive Dynamic Programming and Viscosity Solutions of Hamilton-Jacobi-Bellman Equations, *Automatica*, submitted (under review).
10. Jun Moon and Hyun Jong Yang, Linear-Quadratic Time-Inconsistent Mean-Field Type Stackelberg Differential Games: Time-Consistent Open-Loop Solutions, *IEEE Transactions on Automatic Control*, submitted (under review)

#### Peer Reviewed Conference Proceedings (\*: Corresponding author)

1. Ngo Phong Nguyen, Hyun Jong Yang, and Jun Moon\*, “Adaptive Integral Super-Twisting Sliding Mode Control for Uncertain Stochastic Systems”, European Control Conference (ECC 2019), June, 2019, accepted.
2. Myoung Hoon Lee, Jae Hwa Lee and Jun Moon\*, “A Characterization of Backward Reachable Sets for Nonlinear Dynamical Systems via the Pseudospectral Legendre Method”, European Control Conference (ECC 2019), June, 2019, accepted.
3. Ngo Phong Nguyen, Wonhee Kim and Jun Moon\*, “Observer-based Super-Twisting Sliding Mode Control with Fuzzy Variable Gains and Its Application to Overactuated Quadrotors,” *57th IEEE Conference on Decision and Control (CDC)*, Miami, USA, Dec. 2018, pp. 5993-5998.
4. Myoung Hoon Lee and Jun Moon\*, “The Stochastic Maximum Principle for Risk-Sensitive Optimal Control with Delay and Applications,” *57th IEEE Conference on Decision and Control (CDC)*, Miami, USA, Dec. 2018, pp. 7052-7057.
5. Jun Moon\*, “Necessary and Sufficient Conditions for Risk-Sensitive Optimal Control with Delay,” *The SICE Annual Conference 2018 (SICE 2018)*, Sep. 2018, pp.559-562.
6. Youngwoo Lee, Liting Sun, Jun Moon\*, and Masayoshi Tomizuka, “Reference Modulation for Performance Enhancement in Motion Control Systems,” *Proceedings of the 2018 American Control Conference (ACC)*, Milwaukee, USA, June, 2018, pp. 6697-6702.
7. Myoung Hoon Lee, Kyu Taek Oh, Katherine Kim and Jun Moon\*, “Decentralized Optimal Control for Large Populations of Two-Wheeled Vehicles,” *Proceedings of the IEEE Industrial Electronics Society (IECON 2017)*, Beijing, China, Nov. 2017, pp. 3009-3014.
8. Tamer Başar\* and Jun Moon, “Riccati equations in Nash and Stackelberg differential and dynamic games,” *Proceedings of the 20th World Congress of the International Federation of Automatic Control (IFAC)*, Toulouse, France, July 2017, pp. 9957-9964.
9. Jun Moon\* and Tamer Başar, “Discrete-Time Mean Field Stackelberg Games with a Large Number of Followers,” *Proceedings of the 55th IEEE Conference on Decision and Control (CDC)*, Las Vegas, USA, Dec. 2016, pp. 3578-3583.
10. Jun Moon\* and Tamer Başar, “Robust Control of LTI Systems over Unreliable Communication Channels with Unreliable Acknowledgments,” *Proceedings of the IEEE TENCON*, Singapore, Nov. 2016, pp. 3394-3397.
11. Jun Moon\* and Tamer Başar, “Linear-Quadratic Stochastic Differential Stackelberg Games with a High Population of Followers,” *Proceedings of the 54th IEEE Conference on Decision and Control (CDC)*, Osaka, Japan, Dec. 2015, pp. 2270-2275.
12. Jun Moon\* and Tamer Başar, “Discrete-time Decentralized Control using the Risk-sensitive Performance Criterion in the Large Population Regime: A Mean Field Approach,” *Proceedings of the 2015 American Control Conference (ACC)*, Chicago, USA, July 2015, pp. 4779-4784.

13. Jun Moon\* and Tamer Başar, “Linear Quadratic Risk-sensitive Mean Field Games,” *Proceedings of the 53rd IEEE Conference on Decision and Control (CDC)*, LA, USA, Dec. 2014, pp. 2691-2696.
14. Jun Moon\* and Tamer Başar, “Discrete-time LQG Mean Field Games with Unreliable Communication,” *Proceedings of the 53rd IEEE Conference on Decision and Control (CDC)*, LA, USA, Dec. 2014, pp. 2697-2702.
15. Jun Moon\* and Tamer Başar, “Minimax Control of MIMO Systems over Multiple TCP-like Lossy Networks,” *Proceedings of the 19th World Congress of the International Federation of Automatic Control (IFAC)*, Cape Town, South Africa, Aug. 2014, pp. 110-115.
16. Jun Moon\* and Tamer Başar, “Control over Lossy Networks: A Dynamic Game Approach,” *Proceedings of the 2014 American Control Conference (ACC)*, Portland, USA, June 2014, pp. 5367-5372.
17. Jun Moon\* and Tamer Başar, “Estimation over Lossy Networks: A Dynamic Game Approach,” *Proceedings of the 52nd IEEE Conference on Decision and Control (CDC)*, Italy, Dec. 2013, pp. 2412-2417.
18. Jun Moon\* and Tamer Başar, “Control over TCP-like Lossy Networks: A Dynamic Game Approach,” *Proceedings of the 2013 American Control Conference (ACC)*, Washington DC, USA, June 2013, pp. 1581-1586.
19. Jun Moon, Choong Woo Lee, Chung Choo Chung and Young Sik Kim, “Design of Disturbance Observer via the Robust Stabilization and  $H^\infty$  Loop Shaping Methods,” *Proceedings of the 17th World Congress of the International Federation of Automatic Control (IFAC)*, Seoul, South Korea, pp.9272-9277, July, 2008.
20. Jun Moon, Chung Choo Chung, Choong Woo Lee and Young Sik Kim, “A Disturbance Observer Design for SPM-based Data Storage System,” *International Magnetism Conference*, May 2008.

#### Domestic Conferences (\*: Corresponding author)

1. Myoung Hoon Lee and **Jun Moon\***, “Decentralized Optimal Control for Leader-Follower Tilted-Hexarotors,” The Third International Conference On Consumer Electronics (ICCE) Asia, June, 2018.
2. Myoung Hoon Lee and **Jun Moon\***, “Large-Scale Distributed Optimal Control for Two-Wheeled Vehicles,” KSAS, Nov. 2017.
3. Myoung Hoon Lee and **Jun Moon\***, “Decentralized Control of a Two-Wheeled Vehicle Group,” ICROS, May, 2017.

#### Preprints and Working Papers

- “Deterministic and Stochastic Differential Games,” working paper (with Tamer Başar)
- “Risk-Sensitive Control for Fractional Brownian Motion,” working paper (with Tyrone E. Duncan).
- “Mean Field Games for Singularly Perturbed Stochastic Systems,” working paper.
- “Optimal Decentralized Charging for Large Populations of Plug-in Electric Vehicles,” working paper.

#### Workshop



- “Risk-Sensitive Mean field Games via the Stochastic Maximum Principle,” *18th International Symposium on Dynamic Games and Applications*, Grenoble, France, July, 2018.
- “Linear-Quadratic Stochastic Differential Stackelberg Games with a High Population of Followers,” *The 4th Midwest Workshop on Control and Game Theory*, Iowa State University, Apr. 2015.
- “Linear Quadratic Risk-sensitive Mean Field Games,” *The 3rd Midwest Workshop on Control and Game Theory*, Ohio State University, Apr. 2014.

#### Poster Presentation

- “Discrete-time Decentralized Control using the Risk-sensitive Performance Criterion in the Large Population Regime: A Mean Field Approach,” *The AFOSR MURI, 4th year review*, University of Illinois at Urbana and Champaign, Apr. 2015.

#### Patents

- Choong Woo Lee, Young Sik Kim, Jun Moon, Ji Young Jeong, Chung Choo Chung, “Data Storage Apparatus, Assembling Method Thereof and Apparatus for Generating Tracking Position Error Signal,” Nov. 15, 2011, No. US-8059-518, US Patent.
- Choong Woo Lee, Young Sik Kim, Jun Moon, Chung Choo Chung, Ji Young Jeong, Won Hyuk Jin, “Data Storage Apparatus and Apparatus for Generating Tracking Position Error Signal,” May 13, 2014, No. 10-13972340000, Korea Patent.