INKYU JANG (장인규)

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Research Interests

Robot Safety, Receding-Horizon Motion Planning, Stochastic Control

Education

Ph.D. Student, Aerospace Engineering — September 2020 – present
Seoul National University, Seoul, Korea
Laboratory for Autonomous Robotics Research (LARR)
Advisor: Prof. H. Jin Kim

B.S., Mechanical Engineering — March 2014 – February 2020
Seoul National University, Seoul, Korea
summa cum laude

Publications

* equal contribution

Under Review

[U1] Enhancing feature tracking reliability for visual navigation using real-time safety filter
D. Kim*, **I. Jang***, Y. Han, S. Hwang, and H. J. Kim

[U2] Invariance guarantees using continuously parametrized control barrier functions
I. Jang, and H. J. Kim

[U3] Decentralized trajectory planning for quadrotor swarm in cluttered environments with goal convergence guarantee
J. Park, Y. Lee, **I. Jang**, and H. J. Kim

Journal Articles

[J1] Safe motion planning and control for mobile robots: A survey
S. Hwang, **I. Jang**, D. Kim, and H. J. Kim
*International Journal of Control, Automation, and Systems (**IJCAS**)*, 2024. (accepted)

[J2] Towards fully integrated autonomous excavation: Autonomous excavator for precise earthcutting and onboard landscape inspection
I. Jang*, J. Kim*, D. Lee*, C. Kim*, C. Oh, Y. Kim, S. Woo, H. Sung, and H. J. Kim
*IEEE Robotics and Automation Magazine (**RAM**)*, 2024. (accepted)

[J3] Safe control for navigation in cluttered space using multiple Lyapunov-based control barrier functions
I. Jang, and H. J. Kim
*IEEE Robotics and Automation Letters (**RA-L**)*, vol. 9, no. 3, pp. 2056-2063, March 2024.

[J4] DLSC: Distributed multi-agent trajectory planning in maze-like dynamic environments using linear safe corridor
J. Park, Y. Lee, **I. Jang**, and H. J. Kim
*IEEE Transactions on Robotics (**T-RO**)*, vol. 39, no. 5, pp. 3739-3758, October 2023.

[J5] A hybrid controller enhancing transient performance for an aerial manipulator extracting a wedged object
J. Byun, **I. Jang**, D. Lee, and H. J. Kim
*IEEE Transactions on Automation Science and Engineering (**T-ASE**)*, vol. 21, no. 3, pp. 3264-3273, July 2024.

[J6] Real-time robust receding horizon planning using Hamilton-Jacobi reachability analysis
H. Seo, D. Lee, C. Y. Son, **I. Jang**, C. J. Tomlin, and H. J. Kim
*IEEE Transactions on Robotics (**T-RO**)*, vol. 39, no. 1, pp. 90-109, February 2023.

[J7] Learning and generalizing cooperative manipulation skills using parametric dynamic movement primitives
H. Kim, C. Oh, **I. Jang**, S. Park, H. Seo, and H. J. Kim
*IEEE Transactions on Automation Science and Engineering (**T-ASE**)*, vol. 19, no. 4, pp. 3968-3979, October 2022.

[J8] Fast computation of tight funnels for piecewise polynomial systems
I. Jang, H. Seo, and H. J. Kim
*IEEE Control Systems Letters (**L-CSS**)*, vol. 6, pp. 2234-2239, 2022.

[J9] Aerial manipulator pushing a movable structure using a DOB-based robust controller
D. Lee, H. Seo, **I. Jang**, S. J. Lee, and H. J. Kim
*IEEE Robotics and Automation Letters (**RA-L**)*, vol. 6, no. 2, pp. 723-730, April 2021.
ICRA 2021 Best Paper Award on Unmanned Aerial Vehicles

[J10] Fail-safe flight of a fully-actuated quadrotor in a single motor failure
S. J. Lee, **I. Jang**, and H. J. Kim
*IEEE Robotics and Automation Letters (**RA-L**)*, vol. 5, no. 4, pp. 6403-6410, October 2020.

[J11] Fully actuated autonomous flight of thruster-tilting multirotor
S. J. Lee, D. Lee, J. Kim, D. Kim, **I. Jang**, and H. J. Kim
*IEEE/ASME Transactions on Mechatronics (**T-MECH**)*, vol. 26, no. 2, pp. 765-776, April 2021.

[J12] Learning transformable and plannable se(3) features for scene imitation of a mobile service robot
J. H. Park, J. Kim, Y. Jang, **I. Jang**, and H. J. Kim
*IEEE Robotics and Automation Letters (**RA-L**)*, vol. 5, no. 2, pp. 1664-1671, April 2020.

Conference Proceedings

[C1] Leakage rate as a measure of continuous-time stochastic set invariance
I. Jang, M. Yoon, and H. J. Kim
*2024 63rd IEEE Conference on Decision and Control (**CDC**)*

[C2] Safe receding horizon motion planning with infinitesimal update interval
I. Jang, S. Hwang, J. Byun, and H. J. Kim
*2024 IEEE International Conference on Robotics and Automation (**ICRA**)*

[C3] Invariance guarantees using continuously parametrized control barrier functions
I. Jang, and H. J. Kim
*2023 23rd International Conference on Control, Automation and Systems (**ICCAS**)*
ICCAS 2023 Best Student Paper Award

[C4] Safe and distributed multi-agent motion planning under minimum speed constraints
I. Jang, J. Park, and H. J. Kim
*2023 IEEE International Conference on Robotics and Automation (**ICRA**)*

[C5] Decentralized deadlock-free trajectory planning for quadrotor swarm in obstacle-rich environments
J. Park, **I. Jang**, and H. J. Kim
*2023 IEEE International Conference on Robotics and Automation (**ICRA**)*

[C6] DHRL: A graph-based approach for long-horizon and sparse hierarchical reinforcement learning
S. Lee, J. Kim, **I. Jang**, and H. J. Kim
*2022 36th Conference on Neural Information Processing Systems (**NeurIPS**)*
Oral Presentation

[C7] Robust and recursively feasible real-time trajectory planning in unknown environments
I. Jang, D. Lee, S. Lee, and H. J. Kim
*2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**)*

[C8] Real-time motion planning of a hydraulic excavator using trajectory optimization and model predictive control
D. Lee*, **I. Jang***, J. Byun, H. Seo, and H. J. Kim
*2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**)*

[C9] Stability and robustness analysis of plug-pulling using an aerial manipulator
J. Byun, D. Lee, H. Seo, **I. Jang**, J. Choi, and H. J. Kim
*2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**)*

[C10] Provably safe real-time receding horizon trajectory planning for linear time-invariant systems
I. Jang, D. Lee, and H. J. Kim
*2020 20th International Conference on Control, Automation and Systems (**ICCAS**)*
ICCAS 2020 Outstanding Paper Award

[C11] Efficient multi-agent trajectory planning with feasibility guarantee using relative Bernstein polynomial
J. Park, J. Kim, **I. Jang**, and H. J. Kim
*2020 IEEE International Conference on Robotics and Automation (**ICRA**)*
ICRA 2020 Multi-Robot Systems Award Finalist

Honors

Scholarships and Grants

Research Grant for Doctorate Research (박사과정생 연구장려금), NRF Korea	2024 – 2026
Brain Korea 21 (BK21) Research Fellowship	2021 – 2022
The National Scholarship for Science and Engineering	2018 – 2020

Awards

ICCAS 2023 Best Student Paper Award	2023
Top Prize, Korea Aerospace Industries (KAI) Aerospace Paper Award	2022
ICRA 2021 Best Paper Award on Unmanned Aerial Vehicles	2021
ICRA 2020 Multi-Robot Systems Award Finalist	2020
ICCAS 2020 Outstanding Paper Award	2020
Outstanding B.S. Thesis Presentation Award	2019
Silver Medal, 6th International Olympiad on Astronomy and Astrophysics (IOAA)	2012

Invited Talks

Safety filter in complex environments using continuously parametrized invariant sets Semiautonomous Seminar, UC Berkeley	August 2024
Invariance guarantees using continuously parametrized control barrier functions 2024 ICROS Conference (제어로봇시스템학회 학술대회), Daejeon, Korea	July 2024

Other Activities

Visiting Student Researcher 2024
University of California at Berkeley, Berkeley, CA, USA
Hybrid Systems Laboratory (advisor: Prof. Claire J. Tomlin)

Projects

Safety Filter Design for Real-Time Safety Assurance of Autonomous Mobile Robots National Research Foundation (NRF), Korea	2024 – present
Motion Planning and Environment Perception for Autonomous Wheel Loader System HD Hyundai Construction Equipment	2022 – present
Online Path Planning Algorithms for Multi-Robot System Hyundai Motor Company	2022 – 2023
Motion Planning and Landscape Inspection Algorithms for Autonomous Excavator System Hyundai Construction Equipment	2020 – 2022

Skills

Programming

(Expert) C/C++, Python, Matlab
(Intermediate) C#, Julia, Javascript, Typescript

Tools / Platform

ROS1, ROS2, WinForm, TCP/IP, STM32

Math Topics

Riemannian Geometry, Lie Group Theory, Stochastic Calculus