SOOYONG KIM

Robotics & Autonomous Systems Engineer

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PROFESSIONAL SUMMARY

Mechanical engineer specializing in robotics, nonlinear dynamics, model-based control, and learning-augmented systems. Research experience at the University of Waterloo in autonomous mobile robotics and at the University of Victoria in experimental system identification. Develops ROS 2 / Isaac Sim studies by defining physical assumptions, reconstructing models, validating execution, and interpreting quantitative results. Combines hands-on robotics research with technical-analysis and business-development management experience.

CORE TECHNOLOGIES

Robot Modeling & Control: URDF, FK/IK, Jacobians, rigid-body dynamics, computed-torque control, PID, LQR, MPC, residual RL (PPO, SAC, TD3).

Autonomy & Perception: ROS 2, ROS, path planning (A*, Dijkstra, RRT/RRT*), localization, EKF, LiDAR–camera fusion, YOLO, segmentation, tracking.

Development & Validation: Python, C++, Isaac Sim / PhysX, Gazebo, OpenCV, PyTorch, Linux, Git, numerical analysis, time-aligned experimental evaluation.

SELECTED ENGINEERING PROJECTS

UR5e Heavy-Payload Transportation & Residual Reinforcement Learning

ROS 2 Humble · Isaac Sim 6.1 · Computed-torque PD / MPC · PPO / SAC / TD3

- Designed a 3 s Cartesian payload-transfer task using UR5e reach, IK, Jacobian conditioning, acceleration and inverse-dynamics constraints; validated fixed-payload modeling and joint-state-to-Tool0 kinematics.
- Screened 25 computed-torque PD and 30 MPC configurations; selected G025 (Kp=256, Kd=41.6), achieving 1.195 mm Cartesian RMSE for the matched 3 kg case in ROS 2–PhysX.
- Developed bounded six-joint residual policies; for a 3 kg controller model carrying 5 kg in PhysX, PPO reduced Cartesian RMSE from 10.560 to 6.061 mm (42.6%).
- Investigated reverse mismatch (5 kg model / 3 kg actual: 8.039 to 4.585 mm) and intermediate 4 kg transfer, while documenting degraded performance outside intended policy conditions.

Model-Based & Learning-Based Control of a 2-DOF Manipulator

Computed-Torque Control · Pure SAC · Residual SAC · Cartesian Tracking

- Built an interpretable nonlinear torque-control comparison using a controlled 30% link-2 mass underestimate; exact-model CTC achieved 0.195 mm versus 31.116 mm mismatched Cartesian RMSE.
- Compared model-free SAC (4.662 mm) with CTC + residual SAC (1.290 mm); checked learned torque against the analytical model deficit rather than using tracking error alone.

Robot-Aware Path Planning & Navigation

Dijkstra · A* · RRT / RRT* · Robot Footprints · Clearance

- Benchmarked graph-based and sampling-based planners, then incorporated robot footprint inflation, continuous collision checks, trajectory refinement, and mission-level feasibility.
- Compared TurtleBot3 and Clearpath Ridgeback on 100 common missions, separating geometric feasibility from path-search performance.

Perception & Sensor Fusion Systems

ROS 2 · YOLO · OpenCV · LiDAR · Camera · EKF

- Implemented real-time detection, tracking and segmentation; measured 31.95 FPS over 2,136 frames with 18.26 ms mean processing latency.
- Developed geometric LiDAR–camera projection and association in Isaac Sim; independently evaluated an EKF fusing wheel odometry and IMU.

EDUCATION

University of Waterloo | PhD Program, Mechanical & Mechatronics Engineering · 2020–2021 (voluntary withdrawal)

University of Victoria | MASc, Mechanical Engineering · 2016–2019

Pusan National University | B.Sc., Mechanical Engineering · 2005–2012

RESEARCH EXPERIENCE

University of Waterloo — Research Assistant | 2020–2021

- Mobile-robot navigation, localization, sensing, MPC-based path following and physical experiments on Summit robotic platforms; LiDAR–camera semantic research and ROS laboratory development.

University of Victoria — Research Assistant | 2016–2019

- Experimental modal analysis, operational modal identification, turning chatter prediction, machining vibration measurement, and validation of dynamics models against laboratory data.

PROFESSIONAL EXPERIENCE

MKS Investments — Manager, Tech Research & Analysis / Business Development | 2023–2026

- Managed technical and market research, challenged assumptions and data quality, evaluated feasibility, and translated findings into decisions for management and stakeholders.

PUBLICATION & SELECTED ACHIEVEMENTS

S. Kim and K. Ahmadi, “Estimation of vibration stability in turning using operational modal analysis,” Mechanical Systems and Signal Processing (2019). Korean patent application 10-2012-0109237 (SOFC system); Grand Prize, Integrated Capstone Design Competition (2011).