Mertcan Kaya

Doctoral Candidate & Research Associate

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Research Output: 3 Journal Articles — 6 Conference Proceedings — 2 Active Manuscripts

Research Summary

My research focuses on human-robot interaction, with an emphasis on motor interference, human movement adaptation, spatial negotiation, and congruency-sensitive robot motion planning. I combine behavioral experimentation, computational modeling, and robotic motion generation to improve predictive coordination and physical collaboration between humans and robots.

Research Contributions

- Developed motor-interference paradigms for evaluating human-likeness in robot motion.
- Investigated spatial adaptation and biomechanical negotiation during human-robot collaboration.
- Proposed computational measures for quantifying interference-driven movement variability.
- Developed adaptive robot-control algorithms based on recursive parameter estimation.

Academic & Research Appointments

Research Associate (Wissenschaftlicher Mitarbeiter) Dec 2025 – Present
Coburg University of Applied Sciences and Arts – Dept. of Electrical Engineering and CS *Coburg, Germany*
Advisor: Prof. Dr.-Ing. habil. Kolja Kühnlenz

- Developing hierarchical motion-planning frameworks using inverse optimal control and dynamic state estimation for human-robot collaboration.
- Implementing real-time trajectory generators on SE(3) to dynamically constrain robot kinematics based on predicted human task sequences.

Research Associate (Wissenschaftlicher Mitarbeiter) May 2021 – Apr 2025
Coburg University of Applied Sciences and Arts – Dept. of Electrical Engineering and CS *Coburg, Germany*
Advisor: Prof. Dr.-Ing. habil. Kolja Kühnlenz

- Designed and conducted human-subject experiments evaluating behavioral adjustments in shared workspaces, managing recruitment, survey design, and statistical analysis.
- Programmed and integrated experimental paradigms using collaborative and social robotic platforms.
- Developed algorithms for numerical data processing and kinematic tracking.

Publications & Research Output

Journal Articles

[1] **Kaya, M.**, Becker, K., Greve, J., Keller, J., Meserle, M., Först, C., Siegel, R., Stelzer, J., & Kühnlenz, K. (2026). Motor interference of elbow configuration changes in human-robot interaction. *Interaction Studies*, 26(1), 130-149. https://doi.org/10.1075/is.25026.kay.

[2] **Kaya, M.**, & Kühnlenz, K. (2025). Subjective task-load influences anthropomorphism during cooperative human and robot hand movements. *Automatisierungstechnik*, 73(1), 22-28. https://doi.org/10.1515/auto-2024-0031.

[3] **Kaya, M.**, Akbulut, M. A., Bayraktaroglu, Z. Y., & Kühnlenz, K. (2024). A novel recursive algorithm for the implementation of adaptive robot controllers. *Journal of Intelligent & Robotic Systems*, 110(3), 115. https://doi.org/10.1007/s10846-024-02135-x.

Conference Proceedings

[4] **Kaya, M.**, Bauer, J., Nickl, F., & Kühnlenz, K. (2025). Towards motor interference of limb configuration changes – A potential measure for human-likeness of robots. *Artificial Intelligence in HCI. HCII 2025.* Springer, Cham. https://doi.org/10.1007/978-3-031-93429-2_9.

[5] **Kaya, M.**, & Kühnlenz, K. (2024). Explorative study on motor interference during synchronous human and robot arm movements under varied presence of a robot head. *2024 IEEE International Conference on Robotics and Biomimetics (ROBIO).* https://doi.org/10.1109/ROBIO64047.2024.10907577.

[6] **Kaya, M.**, & Kühnlenz, K. (2023). Towards prediction of motor interference during synchronous human-robot arm movements using subjective ratings of anthropomorphism. *2023 IEEE International Conference on Robot and Human Interactive Communication (RO-MAN).* https://doi.org/10.1109/RO-MAN57019.2023.10309618.

[7] **Kaya, M.**, & Kühnlenz, K. (2022). Motor interference of incongruent hand motions in HRI depends on movement velocity. *Social Robotics. ICSR 2022.* Springer, Cham. https://doi.org/10.1007/978-3-031-24667-8_30.

[8] **Kaya, M.**, Argın, Ö. F., Akbaş, S., & Bayraktaroğlu, Z. Y. (2018). İşbirlikçi robot uygulamaları için hibrit konum/kuvvet kontrolü. *TOK2018 Otomatik Kontrol Ulusal Toplantısı.* [View on ResearchGate]

[9] Argın, Ö. F., Akbaş, S., **Kaya, M.**, & Bayraktaroğlu, Z. Y. (2018). 6-eksenli endüstriyel manipülatörün eklem sürtünmelerinin tanılanması. *TOK2018 Otomatik Kontrol Ulusal Toplantısı.* [View on ResearchGate]

Preprints & Manuscripts Under Review

[10] **Kaya, M.**, & Kühnlenz, K. (2026). *Disentangling Hardware Embodiment and Trajectory Kinematics During Human-Robot Spatial Negotiation.* Manuscript under review at *Advanced Robotics Research.* Preprint: https://doi.org/10.5281/zenodo.20611666.

[11] **Kaya, M.**, & Kühnlenz, K. (2026). *The Geometry of Interference: Quantifying Spatial Leakage and Biomechanical Adaptation During Human-Robot Collaboration.* Preprint: https://doi.org/10.5281/zenodo.20609858.

Research Funding & Grants

Research Associate, CoSMoC: Congruency-sensitive Human-Robot Motion Coordination 2025 – Present
German Research Foundation (DFG) – Grant ID: KU 2486/9-1

Research Associate, Motor Interference Models for Human-Robot Interaction 2021 – 2025
German Research Foundation (DFG) – Grant IDs: KU 2486/8-1, KU 2486/8-2

Education

Doctoral Candidate in Electrical Engineering & Information Technology Apr 2023 – Present
Technical University of Munich (TUM) – School of Computation, Information and Technology *Munich, Germany*
Cooperative Doctorate with Coburg University of Applied Sciences and Arts
• **Dissertation:** Motor Interference Models for Human-Robot Interaction
• **Advisors:** Prof. Dr.-Ing. Sandra Hirche & Prof. Dr.-Ing. habil. Kolja Kühnlenz

PhD Student in Mechatronics Engineering 2019 – 2021
Istanbul Technical University – Faculty of Mechatronics Engineering *Istanbul, Turkey*
• **Advisor:** Prof. Dr. Zeki Y. Bayraktaroğlu
• *Studies continued through cooperative doctoral program in Germany.*

Master of Science (MSc) in System Dynamics and Control Engineering 2015 – 2019
Istanbul Technical University – Faculty of Mechanical Engineering *Istanbul, Turkey*
• **Thesis:** Compliance Control of Collaborating Robots
• **Advisor:** Prof. Dr. Zeki Y. Bayraktaroğlu

Bachelor of Science (BSc) in Mechanical Engineering 2009 – 2014
Koc University – Department of Mechanical Engineering *Istanbul, Turkey*

Teaching Experience

Guest Lecturer Summer Semester 2025
Coburg University of Applied Sciences and Arts *Coburg, Germany*
Module: Control Engineering 2 (Regelungstechnik 2)

- Delivered academic instruction on advanced control theory methodologies.
- Supervised technical laboratory sessions and evaluated assignments.

Academic Service & Editorial Roles

Associate Editor 2025 – 2026
IEEE International Conference on Advanced Robotics and its Social Impacts (**ARSO 2026**)

- Coordinated peer-review pipelines, evaluated technical submissions, and managed reviewer assignments for contributed papers.

Scientific Peer Reviewer 2022 – Present

- **Journals:** IEEE Transactions on Robotics (T-RO), IEEE Robotics and Automation Letters (RA-L), International Journal of Social Robotics (Springer Nature)
- **Conferences:** IEEE ICRA (2024), IEEE/RSJ IROS (2024), IEEE RO-MAN (2022–2027), IEEE ARSO (2023–2026), IEEE-RAS Humanoids (2022)

Technical & Research Skills

Research Methods:	Human-subject experimentation, Behavioral data analysis, Psychometric survey design, Parametric statistical tracking
Robotics Software:	ROS, ROS 2, MATLAB, Simulink, CoppeliaSim (V-REP), VxWorks RTOS
Programming:	C/C++, Python (NumPy, SciPy), Java, R
Robotic Platforms:	Franka Emika Panda, Universal Robots (UR3), Stäubli RX160, Pepper, NAO, TurtleBot 4
CAD/CAM/CAE:	Siemens NX, SolidWorks, CATIA, ANSYS, COMSOL Multiphysics

Open-Source Research Projects (GitHub)

Robot Simulation MATLAB GUI • Real-time 3D kinematic trajectory updates via MATLAB App Designer.
Adaptive Newton-Euler Algorithm Simulation • Computational simulation for adaptive robot controllers.
Probabilistic Mobile Robot Simulation • Algorithms for mobile robot localization, mapping, and planning.

Honors & Awards

- **Vehbi Koc Scholar Award:** Bestowed twice for achieving a Semester Point Average $\geq$ 3.60 / 4.00.
- **Koc University Undergrad Scholarship:** Awarded a 50% merit scholarship for placing in the **top 5%** nationwide.

Languages

Turkish (Native), English (Advanced C1), German (B1 Certified), Russian (A1)