Çağrı Ege Altunkaya

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Summary of Expertise

Highly motivated Research Assistant specializing in advanced flight control design and safety-critical systems. Expertise includes applying nonlinear control theory, developing autopilots, and modeling complex aircraft systems. Proven ability to translate theoretical concepts into practical aerospace applications, supported by extensive research and industrial experience in stability and control.

Education

Istanbul Technical University — Istanbul, Turkey
M.Sc. in Defense Technologies, Autonomous Systems Track — *July 2023*
- **GPA:** 3.94 out of 4.
- **Dissertation:** Online loss of control prevention of an agile aircraft: Lyapunov-based dynamic command saturation approach.

Istanbul Technical University — Istanbul, Turkey
B.Sc. in Astronautical Engineering — *July 2021*
- **GPA:** 3.65 out of 4 (4th rank out of 60 in the department).

Professional Experience

Aviation Institute Istanbul Technical University — Istanbul, Turkey
Research Assistant — *March 2022 – Present*
- Research on flight control systems, linear and nonlinear control theory, robust control, optimal control, fault-tolerant control, control allocation, safety-critical control and its aerospace applications, e.g. flight envelope protection, automatic ground collision avoidance system design, autonomous maneuver generation.
- Numerous industrial and academical projects have been conducted and/or contributed.
- 10+ Theses of B.Sc. and M.Sc. students were supervised and mentored.

Turkish Aerospace — Istanbul, Turkey
Flight Dynamics and Control Engineer — *Nov 2021 – Feb 2022*
- Landing gear shimmy modeling and landing gear design optimization, considering shimmy minimization – HURJET

Research Experience

Anti-skid Braking System Control Design — Academia-Industry Collaboration Project
Control System Design Researcher — *Aug 2025 – Dec 2025*
- Online runway friction coefficient estimation algorithm was designed using a Levenberg-Marquardt damped super-twisting sliding mode estimator with particle swarm optimization.
- Online tire radius estimation algorithm was designed using concurrent learning.
- Designed control and estimation algorithms for aircraft anti-skid braking systems were designed and implemented.
- Braking efficiency was maximized, thereby optimal braking was achieved.

Image Based Visual Servoing for Drone-to-Drone Engagement — Academic/Experimental Project
Guidance and Control System Design Researcher — *Feb 2025 – Present*
- Visual servoing algorithms were developed for autonomous drone engagement scenarios using control Lyapunov and control barrier functions.
- Computer vision was integrated with flight control loops for real-time target tracking.

Flight Envelope Protection Algorithm Design for Active Sidestick — Academia-Industry Collaboration Project
Control System Design Researcher — *Jan 2024 – Jan 2025*
- Conventional and innovative flight envelope protection algorithms were designed using control barrier functions.
- The real-time implementation of an active sidestick was conducted.
- Control barrier functions were simulated and validated for safety assurance.

Unmanned Air Vehicle Multi-Disciplinary Design Optimization   Academia-Industry Collaboration Project
Multi-Disciplinary Design Researcher   *Jan 2023 – June 2023*
- Multi-disciplinary design optimization was performed for a subsonic unmanned air vehicle, considering aerodynamics, flight performance, and static/dynamic flight stability.

Very Light Aircraft Design   Academia-Industry Collaboration Project
Undergraduate Student Researcher   *March 2019 – Sep 2023*
- **Flight Stability and Control:** Optimization of empennage and wing designs, analytical calculations of stability derivatives based on CFD solutions, USAF DATCOM analysis, mathematical model, various trim algorithms, generation aerodynamics database to feed mathematical model, numerical linearization, static and dynamics stability analysis, flying and handling quality analysis, examining EASA CS-VLA and MIL-F-8785C regulations with mathematical model, CDR report.
- **Air Vehicle Group Leader:** Providing coordination inside the group and with other groups, scheduling, systems engineering.
- **Project Leader:** Providing coordination inside the project between various disciplines and with TAI, scheduling, systems engineering.

PUBLICATIONS

Journal Articles

- **Altunkaya, E. C.**, Çatak, A., Demir, M., Koyuncu, E., & Özkol, İ. (2025). Aircraft Stability and Safety: Practical Applications of Control Lyapunov and Barrier Functions. Journal of Guidance, Control, and Dynamics.
- **Ç. Altunkaya, E.**, & Özkol, İ. (2025). Nuisance-Free Ground Collision Avoidance Design with Adaptive Exponential Control Barrier Functions. Journal of Guidance, Control, and Dynamics, 1-15.
- **Altunkaya, E. Ç.**, & Özkol, İ. (2025). Supermaneuver Control Using a Self-Tuning Strategy Without Thrust Vectoring. Journal of Guidance, Control, and Dynamics, 48(8), 1941-1952.
- Demir, M., **Altunkaya, E. C.**, Çatak, A., Erol, F., Koyuncu, E., Özkol, İ., & Zengin, U. (2025). Stealth-Maneuver Generation for Non-Stealth Aircraft: A Control Barrier Function Approach. Aerospace, 12(6), 478.
- **Ç. Altunkaya, E.**, Çatak, A., Koyuncu, E., & Özkol, İ. (2025). Loss-of-Control Prevention of an Agile Aircraft: Dynamic Command Saturation Approach. Journal of Guidance, Control, and Dynamics, 48(2), 424-436.
- **Altunkaya, E. C.**, & Ozkol, I. (2023). Stick-free flight stability problem revisited: A modeling and simulation approach. Aerospace, 10(3), 234.
- **Altunkaya, E. C.**, & Ozkol, I. (2022). Multi-parameter aerodynamic design of a horizontal tail using an optimization approach. Aerospace Science and Technology, 121, 107310.

Conference Proceedings and Preprints

- Catak, A., **Altunkaya, E. C.**, Demir, M., Koyuncu, E., & Ozkol, I. (2025, August). Radar Cross-Section Shadowing: Novel Task Sharing Concept for Manned-Unmanned Teaming. In 2025 IEEE Conference on Control Technology and Applications (CCTA) (pp. 345-350). IEEE.
- **Altunkaya, E. C.**, Catak, A., Erol, F., Demir, M., Koyuncu, E., & Ozkol, I. (2025, August). Control Barrier Functions as Autonomous Pilots for Low-Observability of Aircraft Against Mobile Radar. In 2025 IEEE Conference on Control Technology and Applications (CCTA) (pp. 208-213). IEEE.
- **Altunkaya, E. C.**, Catak, A., Koyuncu, E., & Ozkol, I. (2024). Innovative Gain Reconfiguration for Active Fault-Tolerant Flight Control: Balance of Stability and Agility. arXiv preprint arXiv:2406.01251.
- **Altunkaya, Ç. E.**, Erol, F., Çatak, A., Mert, V., Capone, P., Ertürk, Ş. A., & Koyuncu, E. (2024). Active Sidestick Control Integration for Enhanced Aircraft Flight Envelope Protection. IFAC-PapersOnLine, 58(30), 218-223.
- Catak, A., **Altunkaya, E. C.**, Demir, M., Koyuncu, E., & Ozkol, I. (2024). Enhanced Flight Envelope Protection: A Novel Reinforcement Learning Approach. IFAC-PapersOnLine, 58(30), 207-212.
- **Altunkaya, E. C.**, & Ozkol, I. (2023). Auto-landing Fault-Tolerant Control System Design for a Light Aircraft. In AIAA SCITECH 2023 Forum (p. 2510).

TEACHING & AWARDS

Academic Performance Award   Istanbul Technical University
Recipient   *Dec 2025 (Pending)*
- 2026 Outstanding Academic Performance Award will be recognized by Istanbul Technical University, owing to my record of having the highest number of journal and conference publications in 2025.

Teaching Assistant   Istanbul Technical University
TA   *Nov 2025*
- Teaching assistance was provided for departmental courses (Discrete Mathematics), and over 10 B.Sc. and M.Sc. students were supervised on their theses, guiding them through research and helping them publish conference papers.

Technical Skills

Programming & Software: MATLAB, Simulink, USAF DATCOM
Languages: Turkish (native), English (professional working proficiency), German (beginner), Spanish (beginner)