İZZET KAĞAN ERÜNSAL

PhD candidate, robotics expert, mechatronics system engineer

PERSONAL DATA

Place and date of birth	Ankara/Turkey, 12.10.1988
Address	EPFL ENAC IIE DISAL GR A2 465, 1015 Lausanne, Switzerland
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EDUCATION

École polytechnique fédérale de Lausanne (EPFL) *November 2023 - April 2024 (Expected)*
Postdoctoral fellow in Distributed Intelligent Systems and Algorithms Laboratory (DISAL)

École polytechnique fédérale de Lausanne (EPFL) & *November 2017 - November 2023*
Instituto Superior Técnico (IST)
PhD candidate in joint doctoral program (RBCog)
Robotics, Control and Intelligent Systems (EPFL)
Electrical and Computer Engineering (IST)
Thesis title: *Distributed Predictive Formation Control of Autonomous Rotary-Wing Micro Aerial Vehicles*

Middle East Technical University (METU) *September 2012 - September 2015*
MSc in Electrical and Electronics Engineering *CGPA: 3.86/4.00*
Control systems area
Thesis title: *System identification and control of a sea surface vehicle*

Middle East Technical University (METU) *September 2008 - June 2012*
Minor in Mechatronics *CGPA: 3.86/4.00*
Topics: *Mobile robots, computer vision, microprocessors, digital signal processing*

Middle East Technical University (METU) *September 2006 - June 2011*
BSc in Mechanical Engineering *CGPA: 3.85/4.00, 3rd ranking*
Control systems area
Graduation project title: *Inverted pendulum test setup for control engineering students*
(Includes English preparation year)

WORK EXPERIENCE

Distributed Intelligent Systems and Algorithms Laboratory, EPFL *September 2019 - Present*
Doctoral teaching assistant

- Course supervision
  - Signals, Systems and Instruments, Undergraduate course (4 semesters)
  - Distributed Intelligent Systems, Graduate course (2 semesters)
- Master thesis supervision
  - Hugo Grall Lucas, *Performance and comparison analysis of linear model predictive control on reference tracking quadrotors*
  - Harsh Jaiswal, *A robust model predictive control approach for trajectory tracking MAVs under wind disturbance*
  - Shashank Demush *Design and Analysis of Modular and Scalable Model Predictive Control for MAVs Performing Formations*

- Semester project supervision
  - Jianhao Zheng, *Distributed model predictive control architectures for multi-rotor micro aerial vehicles*
  - Leo Alvarez, *Establishing a high fidelity communication network among multi-rotor MAVs*
  - Jianhao Zheng, *Comparison of linear and nonlinear model predictive control strategies for trajectory tracking MAVs*
  - Frank Centamori, *Solver comparison for complex and real-time nonlinear model predictive control problems*
  - Tifanny Pereira Portela, *Flocking of multi-rotor micro aerial vehicles via model predictive control with collision avoidance*
  - Theo Gieruc, *Vision-based relative localization solution for a team of quadrotors in formation*
  - Yacine Derder, *Automated calibration algorithm for a 3D infrared relative localization sensor for quadrotors*

Aselsan Inc., SST division *December 2015 - October 2017*
Expert Mechatronic Systems Engineer in Servo and Stabilization Technologies Design Dept.

- Design and implementation of high precision servo and multi-agent task control algorithms for automated air defence mechanisms in embedded environments
- System engineering and mechatronic component selection for serial production

Aselsan Inc., SST division *July 2011 - November 2015*
Mechatronic Systems Engineer in Unmanned Systems Dept.

- Design and implementation of high precision servo and multi-agent task control algorithms for automated air defence mechanisms in embedded environments
- System engineering and mechatronic component selection for prototype development

Aselsan Inc., MGEO division *December 2010 - July 2011*
Candidate Engineer in Mechanic-Optic Design Dept.

- Contributing to research projects and observing work stream
- Mechatronic component selection for an unmanned aerial vehicle

Hidromek Inc. *August 2010 - September 2010*
Intern in R&D Dept.

- Contributing to Finite Element Analysis (FEA) for earth moving machinery
- Designing and conducting minor mechanical engineering experiments to verify FEA

Turkish Aerospace Industries (TAI) *August 2009 - September 2009*
Intern in Manufacturing Dept.

- Observing manufacturing processes
- Contributing to manufacturing of basic aerospace parts

MAIN PROJECTS

DISAL, EPFL *September 2017 - Present*
- Designing a multi-quadrotor robotic system capable of performing various formation structures robustly by leveraging exclusively on-board resources (perception, computation, communication) and employing optimal control strategies (i.e. Model Predictive Control) under different various uncertainties
- Redesign and validation of an infrared-based 3D localization sensor for quadrotors

Aselsan Inc., SST group *January 2012 - October 2017*
Design and implementation of high precision servo and multi-agent task control algorithms for automated air defence mechanisms in embedded environments

METU, Artificial Intelligence Course *September 2013 - January 2014*
Development and comparison of single player-single level Bloxorz game solvers by using BFS, A-Star, RRLT and

Genetic Algorithm

METU, Mechatronic Design Course *March 2011 - July 2011*
Design of an automation test setup for robotics students

METU, Mechanical Engineering Design Course *September 2010 - February 2011*
Design of an inverted pendulum test setup for control engineering students

METU, Mechatronic Components and Instruments Course *September 2010 - February 2011*
Design of 2 DOF color and form tracker stationary robot

METU, Introduction to Mechatronics Course *September 2008 - February 2009*
Design of 2 DOF light tracker stationary robot

PUBLICATIONS

İ. K. Erunsal, D. Dias, R. Ventura, P. Lima, A. Martinoli, *An Infrared-Based 3D Indoor Relative Localization System for Micro Aerial Vehicles*, IEEE/ASME Transactions on Mechatronics, 2024 (in preparation)

C. Baumann, İ. K. Erunsal, A. Martinoli, *Multi-Robot System Architectures*, Encyclopedia of Robotics, 2024 (invited, in preparation)

İ. K. Erünsal, R. Ventura, A. Martinoli, *A Distributed Predictive Architecture for Onboard Tightly-Coupled Estimation and Control of Micro Aerial Vehicle Formations*, International Symposium on Distributed Autonomous Robotic Systems (DARS), November 2022

İ. K. Erünsal, J. Zheng, R. Ventura, A. Martinoli, *Linear and Nonlinear Model Predictive Control Strategies for Trajectory Tracking Micro Aerial Vehicles: A Comparative Study*, International Conference on Intelligent Robots and Systems (IEEE/RSJ IROS), November 2022

İ. K. Erünsal, A. Martinoli, R. Ventura, *Nonlinear Model Predictive Control for Formations of Multi-Rotor Micro Aerial Vehicles: An Experimental Approach*, International Symposium on Experimental Robotics (IEEE ISER), 2020

İ. K. Erünsal, A. Martinoli, R. Ventura, *Decentralized Nonlinear Model Predictive Control for 3D Formation of Multirotor Micro Aerial Vehicles with Relative Sensing and Estimation*, International Symposium on Multi-Robot and Multi-Agent Systems, (IEEE MRS), August 2019

İ. K. Erünsal, M. Kumru, K. Ahıska, "An approach for system identification in unmanned surface vehicles", International Conference on Control, Automation and Systems (ICCAS), 2017

M. Kumru, İ.K. Erünsal, K. Ahıska, K. Leblebicioğlu, *A survey on tactical control algorithms for path tracking unmanned surface vehicles*, International Conference on Control, Automation, Robotics and Vision (ICARCV), November 2016

T. Öztürk, U. Göçmen, İ.K. Erünsal, M. Özen, N. Güleç, *Automatic Ammunition Feeding Mechanism: Design of a Complex Mechatronic System in accordance with Requirement Sets*, Defence Technologies Conference (SAVTEK), October 2016

İ. K. Erünsal, M. Kumru, M. K. Leblebicioğlu, *Control of an unmanned sea-surface vehicle by linear PID, LQR and nonlinear Feedback Linearization methods* Automatic Control Turkish National Committee (TOK) Conference , September 2015

İ. K. Erünsal, *System identification and control of a sea surface vehicle.* Master's Thesis, Middle East Technical University, Electrical and Electronics Eng. Dept., September 2015

HONOURS, AWARDS AND SEMINARS

IEEE Multi-robot Systems Summer School, Czech Technical University in Prague *2019*
Portuguese Science and Technology Foundation (FCT) PhD Scholarship *2017-2021*
Scientific and Technical Research Council of Turkey (TUBITAK) Masters Fellowship *2013-2014*
METU Mechanical Engineering Design Project Success Certificate, Inverted Pendulum Test Setup *2010*
METU High Honor Degree Undergraduate Academic Awards *2007-Fall, 2007-Spring, 2008-Fall,2009-Fall 2009-Spring, 2010-Fall, 2010-Spring*
METU Honor Degree Undergraduate Academic Award *2008-Spring*

COMPUTER SKILLS

Advanced knowledge	Matlab, Simulink, C, C++, Python, ROS 1 & 2, Webots, git
Intermediate knowledge	C#, Docker, SolidWorks, Fusion 360, Key Creator, DOORS, Matcad, Altium, Gazebo, PX4, Ardupilot
Basic knowledge	ADAMS, CNC Simulator, ProEngineer
Operating Systems	Ubuntu, Microsoft, macOS, NuttX
Hardware experience	Pixhawk, Cube, Jetson TK1, Jetson Nano/Xavier NX, Raspberry Pi, TI-C28346, TI-C6713, dsPIC24, dsPIC33, Asctec, Helipal, CrazyFly, VOXL quadrotors

LANGUAGES

Mother tongue	Turkish
Advanced knowledge	English (C2)
Basic knowledge	Portuguese (A1), French (A2)

EXTRA-CURRICULAR

Classical guitar instructor, certificate from Çağlar Music Club
Amateur rower licence, METU rowing team

REFERENCES

Dr. Alcherio Martinoli, Assoc. Prof., ENAC, EPFL, alcherio.martinoli@epfl.ch, +41 21 693 68 91
Dr. Rodrigo Ventura, Assoc. Prof., DEEC, IST, rodrigo.ventura@isr.tecnico.ulisboa.pt, +351 21 841 81 95
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