Doga Yucalan | Curriculum Vitae

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Education

PhD in Aerospace Engineering 2016–2021

Cornell University, Ithaca NY

- Dissertation title: Autonomous Navigation of Relativistic Spacecraft
- Committee: Dr. Mason Peck (chair), Dr. Thomas Hartman, Dr. Dmitry Savransky

BSc in Electrical and Electronics Engineering, *magna cum laude* 2011–2016

Middle East Technical University, Ankara, Turkey

- Adviser: Dr. Tolga Ciloglu

BSc in Physics, *summa cum laude* 2012–2016

Middle East Technical University, Ankara, Turkey

- Adviser: Dr. Hande Toffoli

Teaching Experience

Head Lab Teaching Assistant, System Dynamics Spring ’20

Teaching Assistant, System Dynamics Summer ’19

Homework Liaison, System Dynamics Spring ’18

Mechanical and Aerospace Engineering Department, Cornell University, Ithaca NY

- Assisted 90–100 junior-level undergraduates during up to six two-and-a-half-hour lab sessions.
- Revised and posted weekly homework assignments and homework solutions.
- Explained challenging concepts to students during weekly office hours.
- Held an optional review session on drawing Bode plots.
- Co-authored a lab manual. Created a complementary preparation document for teaching assistants to use before, during, and after the experiment.
- Co-authored a lab report grading rubric. Created homework grading rubrics. Coordinated with graders.
- Graded exams and lab reports.

Mentoring Experience

Graduate Research Mentor Spring ’20

Mechanical and Aerospace Engineering Department, Cornell University, Ithaca NY

- Co-mentored an undergraduate student in developing a star identification method to implement on relativistic spacecraft.

Mentoring Experience (continued)

Spacecraft Subsystem Leader Fall '16–Summer '17

Mechanical and Aerospace Engineering Department, Cornell University, Ithaca NY

- Mentored three undergraduate students in implementing the Guidance, Navigation & Control/Attitude Determination & Control Subsystem of Cislunar Explorers—current finalist of NASA's Lunar CubeQuest.

Senior Design Project Team Leader Fall '15–Spring '16

Electrical and Electronics Engineering Department, Middle East Technical University, Ankara, Turkey

- Led the team of five in constructing a maze-solver robot as senior design project.

Project Sub-team Leader Fall '13–Winter '15

Physics Department, Middle East Technical University, Ankara, Turkey

- Led the Scintillator and Photomultiplier Tubes Sub-team of four in selecting and ordering the scintillators and photomultiplier tubes for a spark chamber.

Senior Team Member Spring '14–Summer '15

Electrical and Electronics Engineering Department, Middle East Technical University, Ankara, Turkey

- Onboarded two new team members to CEMMETU (Computational Electromagnetics at Middle East Technical University).

Alternate Team Leader/Sub-team Leader Fall '14–Spring '15

CANSAT Competition, Abilene TX

- Led the Electronic System Design Sub-team of three in designing the electronic hardware and flight software of a descent vehicle.

Research Experience

Doctoral Researcher

Aerospace Engineering, Cornell University, Ithaca NY

Topic: Autonomous navigation of relativistic spacecraft Fall '17–present

- Derived the analytical solution to relativistic autonomous observation.
- Designed autonomous navigation algorithm for relativistic spacecraft lost in interstellar space.

Topic: Optical navigation in cislunar space Fall '16–Fall '17

- Designed the overall architecture of Cislunar Explorers' (current finalist of NASA's Lunar CubeQuest) Guidance, Navigation & Control/Attitude Determination & Control Subsystem.
- Developed and implemented the image acquisition and camera handling software using OpenCV.
- Planned and performed the verification and validation procedure for the optical navigation software.

Research Experience (continued)

Undergraduate Researcher

Physics Department, Middle East Technical University, Ankara, Turkey

Topic: Searching for quasi-periodic oscillations in 4U 1907+09 — Spring '16

- Applied a Bayesian search method typically used for active galactic nuclei to look for periodicities in short-term time series of an X-ray, accretion powered pulsar.

Topic: Construction of a spark chamber for outreach — Fall '13–Spring '15

- Evaluated scintillators and photomultiplier tubes available in the market and presented findings to METU Astroparticle Team weekly.
- Selected and ordered the scintillators and photomultiplier tubes for construction.
  The instrument started its operation in Summer 2016.

Undergraduate Researcher

Electrical and Electronics Engineering Department, Middle East Technical University, Ankara, Turkey

Topic: Designing a maze-solver robot that can lead a ball through the paths of a maze collaboratively with another robot — Fall '15–Spring '16

- Codesigned the overall architecture of Pamuk's (Honorable Mention winner in the project fair) Percept Handling and Planning Subsystem—responsible for receiving and processing sensory data, decision making, and actuation.
- Developed and implemented the sensing and planning software using OpenCV.

Topic: Designing a descent vehicle that is simulating a spacecraft traveling through a planetary atmosphere while sampling the atmospheric composition — Fall '14–Spring '15

- Designed the overall architecture of METUSAT's (fourth place winner in the 2015 CanSat Competition in Abilene TX) Sensor Subsystem.
- Derived the sensor requirements; evaluated and ordered the sensors for the vehicle.
- Designed and implemented the active descent stabilization system of the vehicle.

Topic: Subwavelength imaging using microwave metamaterials — Spring '14–Summer '15

- Generated a 3D CAD model of a metalens.
- Investigated the surface currents on, and the nearfield behavior of the metalens using Multilevel Fast Multipole Algorithm (MLFMA).
- Determined the region of high resolution and studied the effect of dipole position and orientation on resolution using MLFMA.

Research Experience (continued)

Intern

The AMS-02 Experiment, CERN (European Organization for Nuclear Research), Geneva, Switzerland

Topic: Modeling atmospheric muons to support the spark chamber project — Summer '14

- Generated Monte Carlo analyses to simulate muon distribution on the Earth.
- Obtained beta and charge distributions of cosmic particles, and rigidity distribution of cosmic protons from AMS-02 data.
- Took a TEE Shift for AMS-02 for 48 hours—was responsible for Tracker, TT, TRD, ACS, and TAS subsystems.

Intern

Satellite Technologies Department, TUBITAK-UZAY (Space Technologies Research Institute, Scientific and Technological Research Council of Turkey), Ankara, Turkey

Topic: Modeling Earth's magnetic field, and spacecraft navigation and control — Summer '13

- Modeled Earth's magnetic field by repurposing harmonic synthesis methods typically used for gravitational field.
- Developed a rate estimation algorithm for satellite just separated from the launch vehicle in low Earth orbit.
- Designed a b-dot controller to damp the tumbling of a satellite in low Earth orbit.

Publications

Yucalan, D., and Peck, M. An Optimal Navigation Filter for Relativistic Spacecraft. To be presented at the 2021 AIAA SciTech Forum, Nashville TN, 2021 (in preparation).

Yucalan, D., and Peck, M. Autonomous Navigation of Relativistic Spacecraft Lost in Interstellar Space. AIAA Journal of Guidance, Control, and Dynamics. 2020 (in preparation).

Yucalan, D., and Peck, M. A Static Estimation Method for Autonomous Navigation of Relativistic Spacecraft. Presented at the 2019 IEEE Aerospace Conference, Big Sky MT, 2019.

Cerri-Serim, D., Serim, M. M., **Yucalan, D.**, Sahiner, S., Inam, S. C., and Baykal, A. The Timing Noise of Magnetars. Presented at the 11th INTEGRAL Conference Gamma-Ray Astrophysics in Multi-Wavelength Perspective, Amsterdam, The Netherlands, 2016.

Honors and Awards

Cornell University John McMullen Scholarship	Fall '17, '18, '19, Spring '17
Zonta International Amelia Earhart Fellowship	2018
Assoc. Prof. Bulent Kerim Altay Award	Fall '15
Electrical and Electronics Engineering High Honor Student	Fall '11, '15, Spring '12, '14
Physics High Honor Student	Fall '15, Spring '14, '16
Electrical and Electronics Engineering Honor Student	Fall '12, '13, Spring '15
Physics Honor Student	Fall '12, Spring '13

Professional Affiliations

American Society for Engineering Education — Feb 2020–present

Cornell University NextGen Professors — Oct 2019–present

Cornell University Carl Sagan Institute — Dec 2018–present

Institute of Electrical and Electronics Engineers — Jun 2018–present

American Institute of Aeronautics and Astronautics — Sep 2017–present

Professional Trainings

Courses

Teaching Seminar — Spring '20

Engineering Learning Initiatives, Cornell University, Ithaca NY

Teaching and Learning Physics — Fall '19

Physics Department, Cornell University, Ithaca NY

An Introduction to Evidence-Based STEM Undergraduate Teaching — Summer '19

CIRTL Network

Workshops

Facilitating and Evaluating Group Work and Projects — Fall '19

Center for Teaching Innovation, Cornell University, Ithaca NY

Teaching Interdisciplinarity: Challenges and Opportunities — Fall '19

Center for Teaching Innovation, Cornell University, Ithaca NY

Engineering Teaching Assistant Development Program — Winter '17

College of Engineering, Cornell University, Ithaca NY

Holistic Graduate Admissions — Fall '19

Graduate School Office of Inclusion & Student Engagement and CIRTL at Cornell, Cornell University, Ithaca NY

Community Service

Finance Commission Vice President — Dec 2019–present

Graduate and Professional Student Assembly, Cornell University, Ithaca NY

Finance Commission Officer — Sep 2019–Dec 2019

Graduate and Professional Student Assembly, Cornell University, Ithaca NY

Physical Sciences Division Chief — May 2019–present

Graduate and Professional Student Assembly, Cornell University, Ithaca NY

Physical Sciences and Engineering Voting Member — May 2019–present

Graduate and Professional Student Assembly, Cornell University, Ithaca NY

Community Service (continued)

Archive Manager May 2019–present

Space Systems Design Studio, Mechanical and Aerospace Engineering Department, Cornell University, Ithaca NY

President Aug 2018–present

Proyecto Palante, Cornell University, Ithaca NY

Aerospace Engineering Field Representative May 2018–present

Graduate and Professional Student Assembly, Cornell University, Ithaca NY

Communications Liaison May 2018–present

Sibley Grads in Mechanical and Aerospace Engineering, Mechanical and Aerospace Engineering Department, Cornell University, Ithaca NY

Outreach Coordinator May 2017–May 2018

Sibley Grads in Mechanical and Aerospace Engineering, Mechanical and Aerospace Engineering Department, Cornell University, Ithaca NY

Outreach

Rockets, Boats, and Robots Jun 2019

4-H Career Explorations, Cornell University

Cornell University, Expanding Your Horizons Apr 2019

Sustainable Empowerment

Cornell University, 4-H Career Explorations Jun 2018

Rockets, Boats, Bridges

Cornell University, Big Red Barn Kids Science Day Apr 2018

Boats!

Cornell University, Expanding Your Horizons Apr 2018

Out of This World

Skills

Language Skills

Turkish Native

English Fluent

Spanish Intermediate

Computer Skills

Programming/Markup Languages C, C++, Python, LaTeX

Operating Systems Windows 98/XP/Vista/8/10, Linux

Computer Skills (continued)

Industry Software MATLAB/Simulink, Siemens NX, Arduino IDE, LTspice, MultiSim, Electronics Workbench, Altera, Agilent VEE, most MS Office products (including MS Project), Zotero

Other

Interests Dancing, hiking, singing

Citizenship Turkey

ORCID ID 0000-0003-2926-1928

References

Available upon request.