Gokhan **Cakal**

MSc. Student & Teaching Assistant · Electrical and Electronics Engineering

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Summary

Current MSc. student and teaching assistant at Middle East Technical University, Ankara, Turkey. Has research interest of permanent magnet electrical machines. Working on axial flux permanent magnet machines with novel flat windings manufactured from conductor sheet. Studying on electrical machines and power electronics areas. Researcher at PowerLab Research Group. Completed an industry funded project on the design of air cored rotary voice coil motors. Completed a project on PCB winding permanent magnet synchronous motors.

Education

MSc. on Electrical Machines and Power Electronics

METU (Middle East Technical University) *Sept. 2017 - Ongoing*

- Have thesis topic of axial flux permanent magnet synchronous machines with novel winding design.
- Have CPGA of 3.83/4.
- Expected graduation in September 2020.

BSc. in Electrical and Electronics Engineering

METU (Middle East Technical University) *Sept. 2012 - Jun. 2017*

- Got CPGA of 3.38/4.
- Studied in the area of energy conversion and power electronics.

Minor in Entrepreneurship

METU (Middle East Technical University) *Sept. 2012 - Feb. 2018*

- Developed entrepreneurial skills.

Experience

MSc. Thesis

METU (Middle East Technical University) *Aug. 2017 - Present*

- In my thesis, I studied novel winding designs for electrical machines. Instead of conventional stranded wires, the windings are manufactured from a thin conductor sheet, such as copper or aluminum sheets. Using planar cutting tools, such as water jet, small conductor pieces are cut from the sheet and bent to give a form. Then, by using welding techniques, the stator is assembled.
- During my research, I worked on analytical modeling of the electrical machines. For the magnetic field modeling, I used magnetic scalar potential. I verified my analytical model with finite element solutions and experimental results. For the experimental verification, I manufactured 1.4 kW prototype machine employing novel flat winding, and conducted various tests on it. The patent application has been made for novel flat windings, and it is still in process. I wrote several conference and journal papers about this research.

Project Engineer

PARGE Inc. *Aug. 2017 - May 2019*

- I worked for an industry-funded project on the design of air-cored rotary voice coil actuators. The designed actuator will be used in gimbal systems in aerospace applications, and it has limited-angle rotation with rated torque of 2.3 Nm. During the project, I used optimization and finite element tools. Also, I published a conference paper about the torque ripple minimization of this actuator and presented it in ICEM 2018, Greece.
- As the second phase of this project, I designed a permanent magnet synchronous PCB motor that will be used in aerospace applications. The windings of this type of motor are printed on a PCB, unlike conventional stranded wire winding. It is a tiny motor and has a rated torque of 0.15 Nm. Experimental verification is carried out for this motor.

Teaching Assistant

METU (Middle East Technical University) *May 2018 - Present*

- Until May 2018, I am teaching assistant in my department. I have been the laboratory coordinator of EE361 Electromechanical Energy Conversion-I course. During the semester, I led the experiments on inductors, single, three-phase transformers and DC motors.
- I also led the laboratory of EE362 Electromechanical Energy Conversion-II course. This course is mainly on AC machines. During the semester, I assisted experiments on induction and synchronous machines.
- There is a course for senior undergraduate students on power electronics, EE463 Static Power Conversion. In the laboratory of this course, I assisted the experiments on single and three-phase rectifiers, DC/DC converters, and DC motor drives.

Researcher

PowerLab Research Group *Aug. 2016 - Present*

- PowerLab is a research group under our department, mainly focused on electrical machines, renewable energy, smart grids, and power electronics. As a researcher, I worked on the design and experimental verification of the flyback converter with a rectifier in front. It has 18 V output. Webpage for our research group is here.

Candidate Engineer

Aselsan Inc. *Feb. 2017 - Jun. 2017*

- Aselsan is a leading defense industry company in Turkey. In my last year in undergraduate, I worked in Aselsan as a part-time engineer. I worked on real-time motor control algorithms using Speedgoat real-time simulation and testing machine, which has the capability of hardware in the loop implementation.

Engineering Intern

Aselsan Inc. *Jun. 2016 - Aug. 2016*

- During my summer internship in Aselsan, I worked on three-phase permanent magnet synchronous motor drivers. Using Simulink, I implemented field-oriented vector control algorithm and had chance to do experimental verification.

Engineering Intern

Tubitak MAM (Marmara Research Center) *Jun. 2015 - Aug. 2015*

- During my undergraduate education, I did summer internship of one month in Tubitak MAM. During my internship, I designed a solar panel battery charger. Using Proteus, design and simulation analysis is conducted.

Coordinator

IEEE METU Student Branch *May. 2013 - Jun. 2014*

- IEEE METU is an active student branch that organizes events around campus mostly for engineer students. I took roles in the management of +15 events in this organization.

Publications and Patent

2018	G. Cakal, R. Zeinali and O. Keysan, "Design and Optimization of Reduced Torque Ripple Rotary Voice Coil Motor," 2018 XIII IEEE International Conference on Electrical Machines (ICEM), Alexandroupoli, 2018, pp. 663-669., ICEM 2018
2019	G. Cakal and O. Keysan, "Design of Double Sided Linear Motor with Easy to Manufacture Hairpin Plate Winding," 2019 12th International Symposium on Linear Drives for Industry Applications (LDIA), Neuchatel, Switzerland, 2019, pp. 1-5., LDIA 2019
2020	G. Cakal and O. Keysan, "Axial Flux Permanent Magnet Machine with Novel Flat Winding Made of Laser-Cut Copper Sheet," (Under Review), IET Electric Power Applications
2020	G. Cakal and O. Keysan, "Axial Flux Generator with Novel Flat Wire for Direct-drive Wind Turbines," (Accepted), IET Renewable Power Generation
2020	F. Tokgoz, G. Cakal and O. Keysan, "Design and Implementation of an Optimized Printed Circuit Board Axial-Flux Permanent Magnet Machine,", 2020 International Conference on Electrical Machines (ICEM)
2020	G. Cakal and O. Keysan, "A Winding Method for Electrical Machines" (Patent Pending), Patent
2020	F. Tokgoz, G. Cakal and O. Keysan, "Comparison of PCB Winding Topologies for Axial-Flux Permanent Magnet Synchronous Machines," (Under Review), IET Electric Power Applications

Skills

Software	ANSYS Maxwell, Twin Builder, MATLAB, Simulink, SolidWorks, Altium Designer, Git, LaTeX
Languages	English, Turkish
Social	IEEE Student Branch, table tennis, reading

Selected Courses and Certificates

AA	**EE564 Design of Electrical Machines**, Graduate course
AA	**EE7566 Electric Drives in Electric and Hybrid Electric Vehicles**, Graduate course
AA	**EE563 Generalized Electrical Machine Theory**, Graduate course
AA	**EE553 Optimization**, Graduate course
BB	**EE563 Vector Control of Electric Drives**, Graduate course
-	**ELE613 Switch Mode Power Supplies**, Graduate course
AA	**EE361 Electromechanical Energy Conversion**, Undergraduate
BA	**BA4137 Entrepreneurship**, Minor
BA	**EE464 Power Electronics-II**, Undergraduate
-	**ANSYS Maxwell Certificate**, Numesys
-	**Introduction to Power Electronics**, Coursera
-	**Converter Circuits**, Coursera

References

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Emine Bostancı

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