SERKAN ÖZTÜRK

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EDUCATION

Ph.D. in Electrical and Electronics Engineering, Hacettepe University, Ankara, Turkey **2020**

M.Sc. in Electrical and Electronics Engineering, Hacettepe University, Ankara, Turkey **2014**

B.Sc. in Electrical and Electronics Engineering, Fırat University, Elazığ, Turkey **2010**

RESEARCH INTERESTS

Power Electronics, Wide Bandgap Semiconductor Based Power Conversion Systems, Renewable Energy Systems, Electric Vehicles, Electrical Energy Storage, HF Magnetic Design

PROFESSIONAL EXPERIENCE

Aselsan Inc., Power and Control Systems Design Department **2020-**

Senior Power Electronics Design Engineer

Hacettepe University, Department of Electrical and Electronics Engineering **2011-2020**

Research & Teaching Assistant

TEACHING EXPERIENCE

Hacettepe University full time teaching assistantship for:

- ELE456 - **Power Electronics Laboratory** (Spring 2013, 2014, 2015, 2016, 2017, 2018, 2019)
- ELE479 - **Electrical Machines Laboratory II** (Fall 2014, 2015, 2017, 2018)
- ELE365 - **Electrical Machines Laboratory I** (Fall 2012, 2013, 2014, 2015, 2017, 2018, 2019)
- ELE356 - **Control Systems Laboratory** (Spring 2012, 2014, 2016 ; Fall 2017, 2018, 2019)

Graded homeworks and taught laboratories for these courses.

PROJECT & RESEARCH EXPERIENCE

Funded and In Progress:

(1) Development and Implementation of a 440 VAC, 60 Hz, 7.5 kW Shipboard Power Supply, 2020

- Collaboration: Private Sector
- **Technical Consultant :** The aim of this project is to develop a 7.5 kW AC-DC converter supplied from nominal 440 VAC, 60 Hz shipboard alternating current. A high current carrying capable of DC-DC power stage is cascaded with the AC-DC converter to charge the batteries at the output at different voltages of 28 V or 56 V. Silicon Carbide power semiconductors are used and the switching frequency is chosen as 100 kHz to minimize the sizes of passive and magnetic circuit components. Synchronous rectification is used in the secondary side of the DC-DC converter further to reduce the semiconductor losses and increase the efficiency. All magnetic components are custom designed in the project.

Funded and Completed:

(2) Development Project of Hybrid Heavy Duty Vehicle Components - Design and Implementation of Isolated DC-DC Converter for a 22 kW On-Board Charger Unit, 2018 - 2020

- Funded by TUBITAK (The Scientific and Technological Research Council of Turkey)
- Collaboration: Hacettepe University, ASELSAN INC.
- **Senior Researcher :** The aim of this project is to develop a 22 kW on-board charger (OBC) based on all Silicon Carbide power semiconductors to be used in a hybrid heavy duty vehicle. Owing to the superior material properties of the SiC MOSFET, %99 efficiency for the AC-DC stage, and %98 efficiency for the DC-DC stage is obtained, respectively. The OBC consists of a three phase active PWM rectifier as a PFC cascaded with a zero voltage switching phase-shifted full-bridge DC-DC converter operating at the switching frequencies of 50 kHz and 100 kHz, respectively. All custom magnetic components of the OBC is implemented with nanocrystalline core material for its better thermal properties and lower core losses as compared to ferrite based materials.

(3) Development Project of Electric Vehicle Components - Design and Implementation of New Generation High Power Density Isolated 3.7 kW and 10 kW DC-DC Converters, 2016 - 2018

- Funded by TUBITAK (The Scientific and Technological Research Council of Turkey)
- Collaboration: Hacettepe University, ASELSAN INC.
- **Senior Researcher :** In this project, a 5.6 kW, 50 kHz dual active bridge converter (DAB), based on discrete Silicon Carbide power semiconductors on the primary side, and Silicon based power semiconductors on the secondary side is designed and implemented. The implemented DAB converter is used to charge the auxiliary battery of an electric bus bidirectionally. The converter is also designed to operate in all electric vehicles at 3.7 kW rated power. The output power can be increased to 11.2 kW with the parallel interleaved operation of two DAB converters. The nanocrystalline core materials are used in the implementation of the custom high frequency transformer and the inductor. High density, high efficiency, and more functionality is aimed for the resulting converter to be used in more electric vehicles.

(4) Development of a Supercapacitor Energy Storage System for Braking Energy Recovery in Metro and Light Rail Transportation Vehicles, 2015 - 2017

- Funded by TUBITAK (The Scientific and Technological Research Council of Turkey)
- Collaboration: Hacettepe University, Middle East Technical University, ASELSAN INC.
- **Scholarship Holder :** In this project, a 130 kW, 10 kHz laboratory implementation of a full scale, physical simulator of an all Silicon Carbide half-bridge modules based traction motor drive for Light-Rail Transit Systems with on-board supercapacitor energy storage system is designed and implemented. The whole system consists of a PWM rectifier, a three-phase two-level PWM traction inverter to drive a three-phase squirrel-cage traction motor, a flywheel coupled to the motor shaft, and a supercapacitor energy storage system containing a bidirectional DC-DC converter. This physical simulator can be used in the design, technology development, and performance testing of various types of all Silicon Carbide traction converters, as the future trend in traction applications both for the railway or heavy duty vehicles.

(5) Design and Prototype System Implementation of a Novel 100 kW, Grid Connected Photovoltaic Power Supply With Battery Energy Storage - Design and Implementation of the DC-DC Power Converter, 2013 - 2015

- Funded by TUBITAK (The Scientific and Technological Research Council of Turkey)
- Collaboration: Hacettepe University, Middle East Technical University, Artı Industrial Electronics Ltd.
- **Senior Researcher :** In this project, A 20 kW, 20 kHz high frequency link maximum power point tracking (MPPT) converter for a grid-connected PV supply, based on all silicon carbide (SiC) half-bridge modules, is designed and implemented. The converter size shrinked up to a power density of 1.6 kW/lt, with a DC-DC converter full-load efficiency of 98%. A nanocrystalline core material is used in the implementation of the custom designed HF link transformer. The resulting compact and highly efficient SiC power MOSFET based high frequency link MPPT converter is suggested to be a part of grid-connected, multi-string PV supplies with simple inverter topologies in the future.

(6) Design and Implementation of a Flyback Converter Based Photovoltaic Energy Conversion System, 2012 - 2014

- Funded by Hacettepe University Research Fund
- **Researcher :** In this project, a 120-W, grid-connected microinverter using the Direct Digital Synthesis (DDS) control technique is designed and implemented. All the necessary features of a modern PV microinverter such as the MPPT, the DQ-PLL for grid connection, the LVRT, and the anti-islanding protection are integrated into the software of a low cost dsPIC microcontroller. The implemented microinverter can be used as a module integrated converter (MIC) for photovoltaic systems.

PUBLICATIONS

International Journals (SCI):

No	Index	Description
A1	SCI	**Ozturk, S.,** Cadirci, I., "A Generalized and Flexible Control Scheme for Photovoltaic Grid-Tie Microinverters," in **IEEE Transactions on Industry Applications**, vol. 54, no. 1, pp. 505-516, Jan.-Feb. 2018.
A2	SCI	**Ozturk, S.,** Canver, M., Cadirci, I., Ermis, M., "All SiC Grid-Connected PV Supply with HF Link MPPT Converter: System Design Methodology and Development of a 20 kHz, 25 kVA Prototype," in **Electronics** 2018, 7, 85.
A3	SCI	**Ozturk, S.,** Pospos P., Utalay V., Koc A., Ermis M., Cadirci I., "Operating Principles and Practical Design Aspects of All SiC DC/AC/DC Converter for MPPT in Grid-Connected PV Supplies," in **Solar Energy**, vol. 176, pp. 380-394, 2018.
A4	SCI	Yildirim D., **Ozturk, S.,** Cadirci, I., Ermis, M., "All SiC PWM Rectifier Based Off-Board Ultrafast Charger for Heavy Electric Vehicles," in **IET Power Electronics**, 2019.

International Refereed Conference Papers:

B1	**Ozturk, S.,** "Design of Three Phase Interleaved DC/DC Boost Converter with All SiC Semiconductors for Electric Vehicle Applications," ***IEEE*** *International Conference on Electrical and Electronics Engineering (ELECO)*, Bursa, Turkey, 2017.
B2	M. H. Aksit, **S. Ozturk** and I. Cadirci, "A study on ultracapacitor-based systems for compensation of power deficiency and saving energy: Design, control and simulation," 2017 ***IEEE*** *3rd International Future Energy Electronics Conference and ECCE Asia (IFEEC 2017 - ECCE Asia)*, Kaohsiung, Taiwan, 2017, pp. 1008-1013.
B3	**Ozturk, S.,** Cadirci, I. "Forecasting and Scheduling of a Photovoltaic/Battery Energy Storage System for Load Demand," ***IEEE*** *24th Signal Processing and Communications Applications Conference (SIU), 2016.* doi: 10.1109/SIU.2016.7496184
B4	**Ozturk, S.,** Cadirci, I. "A generalized control approach for photovoltaic grid-tie microinverters," ***IEEE*** *2015 Intl Aegean Conference on Electrical Machines & Power Electronics (ACEMP)*, doi:10.1109/optim.2015.7427006
B5	**Ozturk, S.,** Cadirci, I. "A generalized and flexible control scheme for photovoltaic grid-tie microinverters," ***IEEE*** *International Conference on Renewable Energy Research and Applications (ICRERA)*, 2015. doi:10.1109/icrera.2015.7418501
B6	**Ozturk, S.,** Cadirci, I., "DSPIC microcontroller based implementation of a flyback PV microinverter using Direct Digital Synthesis," ***IEEE*** *Energy Conversion Congress and Exposition (ECCE)*, 2013. doi:10.1109/ecce.2013.6647151

COMPUTER-aided ENGINEERING TOOLS

- **Power Electronics Simulation Software:** PowerSIM, MATLAB/Simulink, LTspice, PLECS
  Proficient in using of simulation, design, analysis and validation tools for power electronics research and product development in various power supplies and control systems. Experience in real time **Hardware-in-the-loop** (HIL) and **Processor-in-the-loop** (PIL) implementation for the validation of the control algorithms.
- **Finite Element Analysis Software:** ANSYS PExprt, PEmag
  In-depth knowledge and hands-on experience for the design, modeling, analysis and optimization of high-power, high-frequency **multi-winding transformers**, **inductors**, and **EMI filters** components.
- **PCB schematic&layout design:** Altium Designer
  Remarkable experience in multilayer PCB layout design ranging from **6 to 12 layers** and schematic capture**.** Also, skilled in high-voltage, high-current layout design depending on the power converter requirements.
- **MCU coding:** Code Composer Studio for Texas Instruments c2000 series Real-time MCUs and Microchip dsPIC series digital signal processors
  Profound skills to implement **digital control algorithms** for closed loop control of AC to DC, DC to DC and DC to AC power converter topologies using real time digital signal processor MCUs. Hands on experience with **SPI, I2C and CAN** communication protocols.

THESES

- **Ph.D.** All SiC Power Semiconductor Based High Efficiency DC-DC Converter Applications –
  Part I: All SiC PSFB MPPT Converter, Part II: All SiC Electric Bus DAB Converter

- **M.Sc.** dsPIC Microcontroller Based Implementation of a Flyback Photovoltaic Microinverter Using Direct Digital Synthesis

PROFESSIONAL MEMBERSHIP

- IEEE Student Member
- IEEE Power Electronics Society Member

JOURNAL REVIEWER ASSIGNMENTS

- IEEE Transactions on Power Electronics
- IEEE Transactions on Industry Applications
- IEEE Journal of Emerging and Selected Topics in Power Electronics

REFERENCES

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