Energy Conversion Innovation (ECI)

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Research at Maryland Power Electronics Laboratory (MPEL)

- Sustainable Energy Conversion Solutions
- Ultra light, Highly Efficient, Low Profile
  - Wide Bandgap Semiconductors
  - Planar Magnetics
  - Electro-Thermal Co-design
  - Additive Manufacturing
- Applications
  - Transportation Electrification
    - Electric Cars, More Electric Aircrafts, Shipboard Power Systems
  - Renewable Energy Systems
    - PV Microinverters
  - Data Centers, Biomedical, IoT

Research at Maryland Power Electronics Laboratory (MPEL)

Integrated Power Electronic Converters

- Onboard charger (OBC) and auxiliary power module (APM) integration
- Propulsion machine integrated OBC
- Integrated wireless and plug-in EV charger

Power Interfaces for Aerospace System

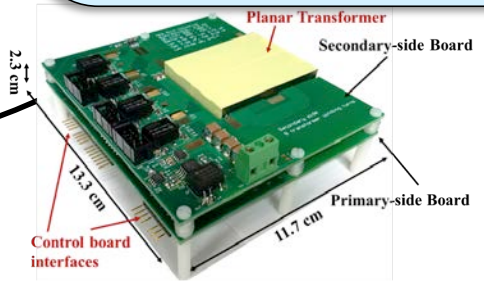
- Wide Bandgap based Regulated Transformer Rectifier Unit for More Electric Aircrafts
- GaN based PV micro-converter for space applications

High Frequency and High Power Density Power Electronic Converters

- MHz frequency high density OBC
- High power density GaN based data center power converter
- Low cost and highly reliable residential PV microinverter
- Thermally integrated 3D printed 1MHz SiC 10kW DC-DC converter

Miniaturized Power Electronic Interfaces

- Miniaturized Power Electronic Interface for biological inspired microrobots
- Pyroelectric energy harvesting interface



MPEL Team

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Ph.D. Student

Daniel J Zakzewski
Ph.D. Student

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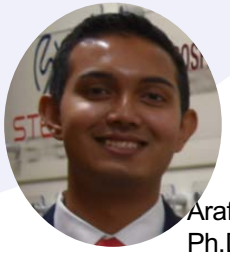


Arafat Hasnain
Ph.D. Student

University of Maryland at College Park

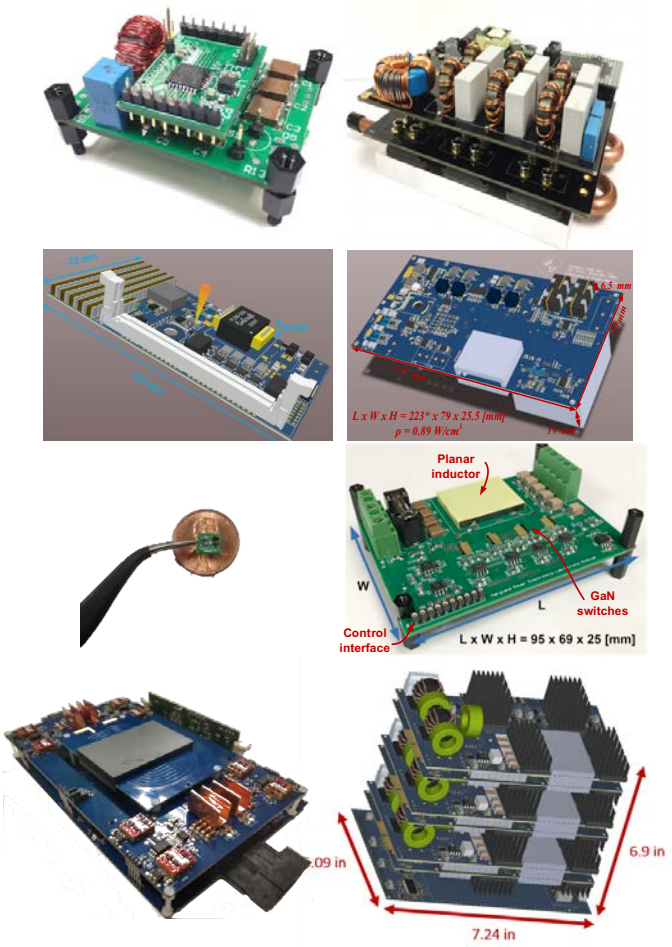
- Established Reputable Power Electronics Research Program
- Technical Journal and Conference Papers

  +200
- Google Scholar Citations

  +12,350
- H-index

  48
- Research Funding (PI/Co-PI)

  +$10 M



University of Maryland at College Park

- Patents / Invention Disclosures

  19 / 21

- Ph.D. / M.Sc. / B.Sc. Supervised

  14 / 12 / 53

- Current Ph.D. / Post-Doc Members

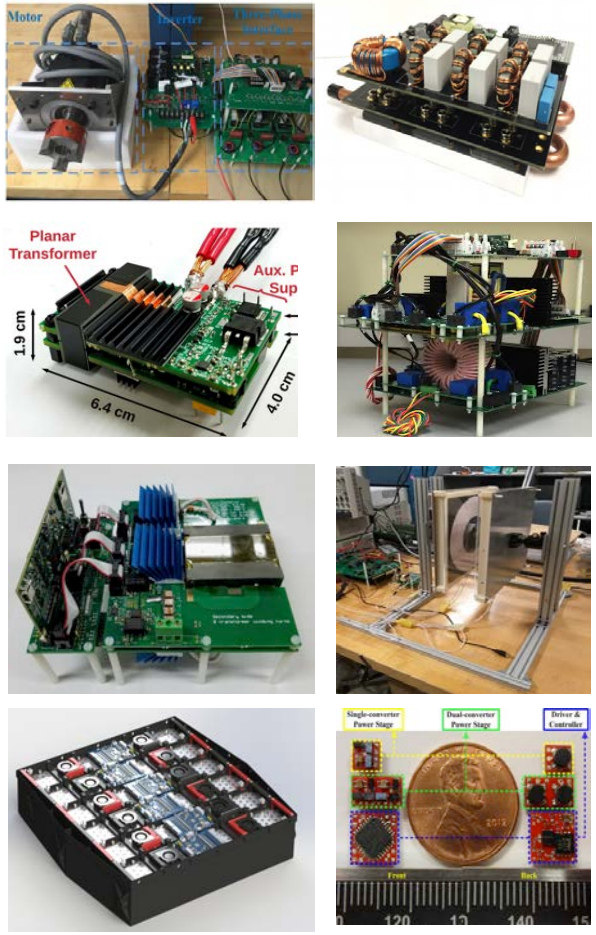
  9 / 3

- Awards and Recognitions

  +30

- Student Awards and Recognitions

  +60



University of Maryland at College Park

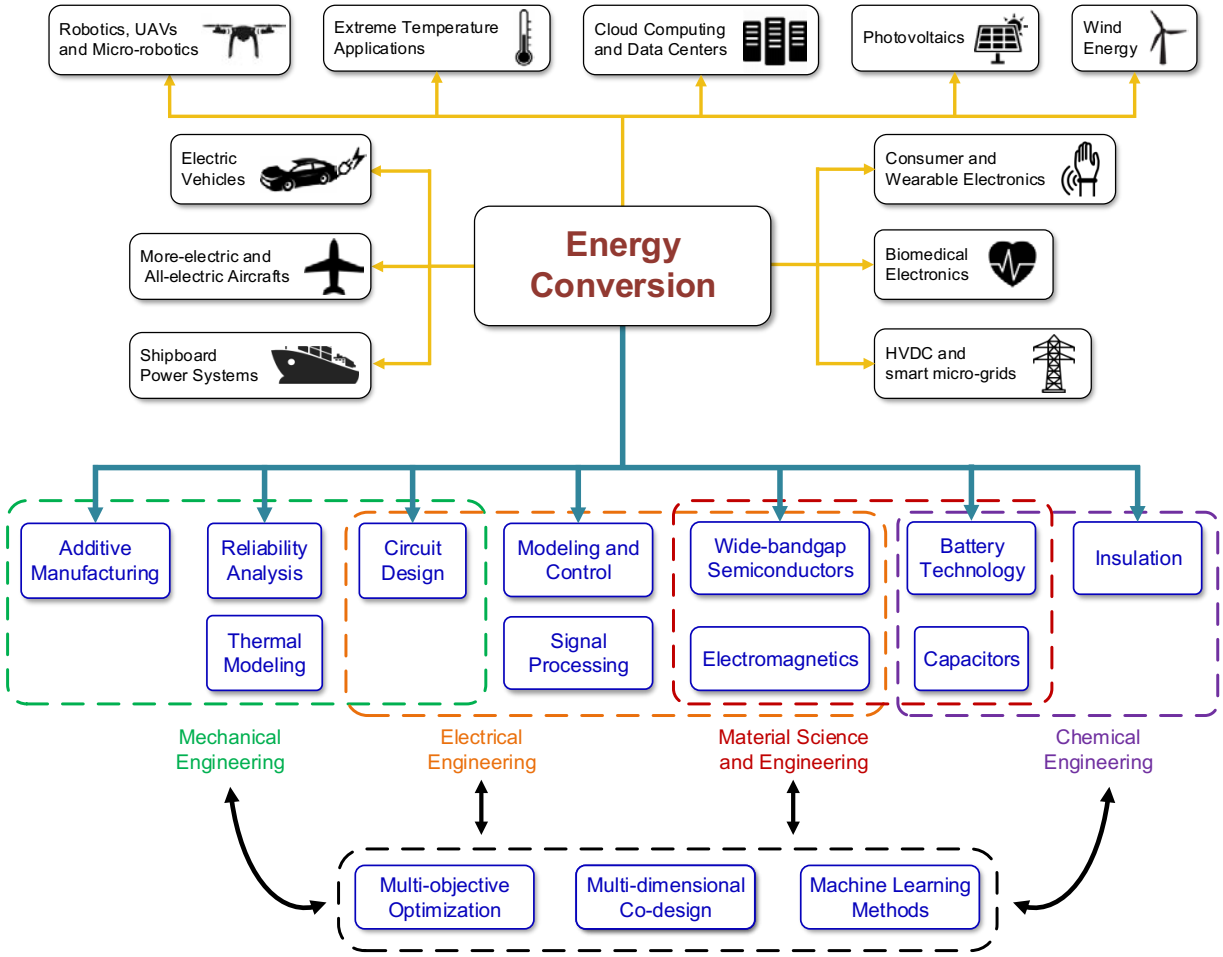
- New Courses
  - ENEE 612: Advanced Power Electronics
  - ENEE 476: Renewable Energy
  - ENEE 408K: Capstone Design Project – Electric Cars
  - ENEE 498K: Advanced Design Laboratory on Electric Cars
  - ENEE 101: Introduction to Electrical & Computer Engineering (One lecture and two laboratory sections)
- NSF REU Site in Transportation Electrification
- NSF IRES Site in Electrified and Autonomous Transportation Systems
- Founding Faculty Advisor, University of Maryland's Terps Racing EV Team

Energy Conversion Innovation

- President Biden's Energy Policy Vision
  - Zero carbon pollution from the U.S. electricity sector by 2035
  - Net-zero economy-wide emissions by 2050
  - $2 trillion investment on renewable energy innovation

- A critical scientific and technological challenges in the U.S. push to expand green energy and infrastructure to combat the threat of climate change

Energy Conversion Innovation



Energy Conversion Innovation

- ECE at UMD is uniquely positioned to develop leading technologies through an Energy Conversion Innovation (ECI) Center.

- Combine aspects of science and engineering to foster partnership between UMD and engineering entities, from government to private sectors.

Relevant Topics

- **High-Frequency and High Performance Power Electronic Systems**
  - By 2030, 80% of the electricity will be processed by Power Electronics.
  - Electrified transportation systems, renewable energy systems, cloud computing and data centers, wearable biomedical and consumer electronics, and distributed generation
- **Optimization and Control of Distributed Energy Conversion Systems**
  - Large-scale multi-frequency power electronics-enabled power systems
  - Smart microgrids, more electric aircrafts, next generation shipboard systems, drones, and data centers among many others.
  - Thousands of building blocks with operating frequencies from a few Hz to a few MHz with complicated system functions.
- **Ultra-Wide Bandgap Semiconductors**
  - Ultrawide-bandgap (UWBG) semiconductors like AlGaN/AlN, Ga2O3, and diamond are emerging as next generation of semiconductors for super high-temperature energy conversion applications.
- **Energy Logistics**
- **Energy Security**

Thank You