Lab Mission: Research and development of enabling technologies to transform today's transportation and electrical power: from generation to transmission to distribution to utilization into more secure, more sustainable, more intelligent, more reliable, and more efficient energy generation-delivery-utilization systems than ever before.

Research Scope and Areas:
- Advanced power conditioning systems for renewable energy sources such as photovoltaic and wind power from one kW to multi-MW systems and grid-connection controls and protections.
- High power density, high temperature, and low cost power converters and inverters for hybrid electric vehicles (HEV), plug-in HEVs, and pure electric vehicles (EVs).
- High voltage high power converters for power system applications such as FACTS devices including static synchronous compensator (STACOM), unified power flow controller (UPFC), etc.
- MW converters and inverters for large motor drives, battery energy storage, and mass transit systems.
- Advanced power electronics circuit topologies and controls: from intelligent gate drives for MOSFETs and IGBTs to new converter/inverter circuitries, from battery protection/voltage balancing circuits to circuit intelligence for self-healing, diagnosis and prognosis.

Research Highlights and Achievements:
- A new power conversion technology – Z-source topology has been developed to achieve buck and boost operation and to overcome the drawbacks of the traditional technology. The new technology is very suited for power conditioning of renewable energy sources such as solar and wind power.
- New multilevel converter/inverter topologies have been developed and demonstrated to achieve high voltage, high power, high efficiency, and high power density.
- High power converters/inverters have been developed for various applications from large motor drives to power system applications. Many of them have been commercialized.
- Over 30 companies, institutes, and government agencies have funded the lab research.

Z-Source converters/inverters, a new power conversion technology. Photo shows a 55-kW prototype.

High voltage high power converter/inverter development. Photo shows a 1.5 MVA Prototype.

55-KW dc-dc boost

6,000-V inverter prototype for motor drives

New multilevel converter/inverter topologies and demonstration