



GRAPES

GRid-connected Advanced Power Electronic Systems

GRAPES MISSION

The center aims to accelerate the integration of power electronics into the electric grid to enhance stability, flexibility, robustness, and economy.

Key objectives include:

- Developing advanced technologies for grid-connected distributed energy resources, power steering and routing devices, and intelligent load-side devices
- Creating software and tools for controlling embedded and grid-connected power electronics to optimize grid performance and manage loads
- Educating engineers on essential power electronic technologies relevant to member companies

RESEARCH

Research will concentrate on design, development, evaluation, control, and standardization of grid-connected power electronic equipment on both the supply and load side of power systems.

Relevant research areas include:

- Power systems, especially off-grid systems such as in transportation systems (ships, planes, trains, automobiles)
- Power electronics devices, characterization, modeling
- Simulation methods and environments for multidisciplinary dynamic systems

SAMPLE PROJECTS

- Compact, GaN Based, 25kW 480VAC Bidirectional Inverter
- High Power Medium Frequency and Medium Voltage Dual Active Bridge

GRADUATED PROJECTS

- Ultrafast Charging-Development of a Compact Direct Medium Voltage Battery Charger
- Power Electronics Controls-Battery Life Extension Method





Engineering and Computing

UNIVERSITY OF SOUTH CAROLINA

ELECTRIC GRID LABORATORY

The Electric Grid Lab at the University of South Carolina is focused on two major topics: (i) High power, high voltage, and high frequency converter, and (ii) Energy management for electrical distribution system and bulk grid.

Features include:

- Over 2000 sq-ft and over 500kVA power supply capabilities (three-phase 480 and 208)
- Full packages of MATLAB/Simulink, PSIM, PSS/E, and PSCAD
- Hardware in loop setups with National Instrument Compact RIO and Typhoon
- High power AC and DC sources, 2000VDC, 60kW, oscilloscopes with high voltage and high current probes, power electronics converters and devices

SOUTH CAROLINA ENERGY AND POWER TESTBED FOR ENGINEERING RESEARCH (SCEPTER) LAB

This lab is focused on digital twin develop for electric ships.

Features include:

- Over 500kVA power supply capabilities (three-phase 480 and 208)
- Electric ship digital twin
- Generators, batteries, active and passive loads, converters
- High power AC and DC sources, oscilloscopes with high voltage and high current probes, power electronics converters and devices

LEVERAGE FOR PARTICIPATING INDUSTRY

- Leverages existing Navy, DOE, and DOD programs at USC
- Electric ship digital twin lab, US Navy
- Development of 1.25MW medium voltage electric vehicle charger
- Extremely compact 500 kW, 2000 Hz inverter for high speed permanent magnet synchronous machines, DOE
- Hybrid and compact integrated energy storage systems

PARTNER UNIVERSITIES



UNIVERSITY OF
ARKANSAS



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