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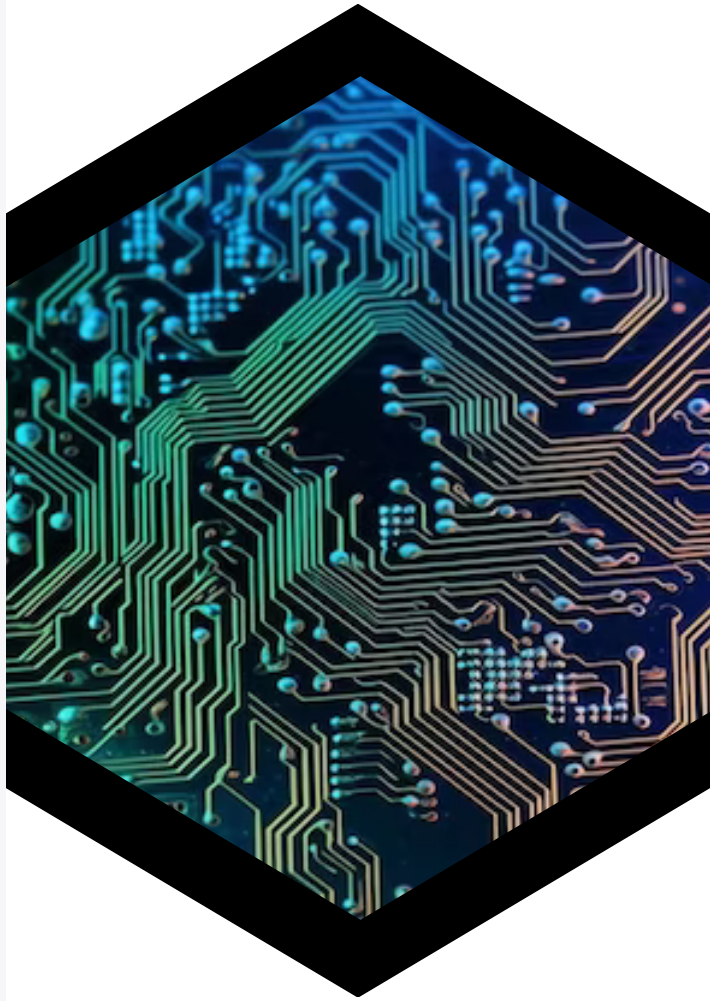
UNIVERSITY OF ARKANSAS | College of Engineering Electrical Engineering and Computer Science

NCREPT

NATIONAL CENTER FOR RELIABLE ELECTRIC POWER TRANSMISSION



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Background

NCREPT (National Center for Reliable Power Transmission) was established for the purpose of investigating solid-state solutions for the electric power grid including protection devices and FACTS as well as energy storage and distributed generation applications.

NCREPT is involved in five areas of research that impact the realization of power electronics solutions:

1) Power Electronic Design and Modeling
2) Power Electronic Packaging
3) Power Electronic Testing
4) Mixed-Signal Integrated Circuit Design
5) Sensors and Controls

Our Mission

The primary mission of the project are in Design, Packaging, and Test of Advanced Power Electronics. Specifically, the center aims:

- To research and develop prototypes of advanced power electronics systems for applications in the power grid including both solid-state protection devices and energy storage
- To develop advanced packaging solutions for high current, high voltage power semiconductor devices and applications
- To establish a state-of-the-art test facility for advanced power electronic circuit and package designs for distribution-level voltages (15 kV-class) and high currents (3000 A at 480 V AC 3-phase)
- To provide much needed human resource in the form of educated students for the newly emerging technologies of the power utility and power electronics sectors

Our Research

Fault Current Limiters

Fault current limiters using high temperature semiconductors offer a possible solution to controlling fault current levels on utility distribution and transmission networks. Such fault current limiters, unlike reactors or high-impedance transformers, will limit fault currents without adding impedance to the circuit during normal operation.

Device Modeling

In order to carry out the design of power electronics using new power device technology such as SiC, new device models are required. The UA team has developed SiC diode, JFET, MOSFET, thyristor (p-type) and IGBT (p-type) device models so that if the designs employ these devices they can successfully be simulated in modern simulators such as the Saber simulator from Synopsys. Thus, power electronic circuits can be designed using such simulation tools.

Mixed-Signal IC Design

The main objective for the IC design effort is to support the designs of the FCL and DER prototypes of the Power Electronics Team. The MSCAD Laboratory is extremely adept at leading edge analog and mixed-signal design in Silicon technologies and is actively seeking to push this into the new realm of Silicon Carbide low-voltage integration.

Facility

The University is home to the most comprehensive university-based electronic packaging facility available in the United States. The Low-Temperature Co-fired Ceramics (LTCC) Laboratory coupled with thin and thick film processing laboratories provides a full range of electronic packaging. Further, accelerated testing equipment is available to perform reliability studies.

NCREPT is a 12,000 square foot, $5M, national-caliber power electronic test facility with three 2 MVA distribution-level test circuits. This medium voltage test facility is capable of 3-phase test circuit regeneration at the 2 MVA level at 480 V, 4.16 kV and 13.8kV. NCREPT also can be reserved (on a fee basis) to support IEEE 1547 and UL 1741 testing of grid-interface equipment, and has successfully supported 3rd-party certifications. The facility has the capability to test truck bed-mounted equipment within its bays. Current DC capability is 750kW. Variable voltage, variable frequency 3-phase power is available at the 750 kVA level. The NCREPT center supports three tiers of service to provide the most economical testing support possible to NCREPT users.