



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

## Senior Design Project Description

<b>Company Name</b>	EPIC/SEL	<b>Date Submitted</b>	June 20, 2017
<b>Project Title</b>	<i>Fault detection in power system with a large ingress of inverter based sources using Time domain protection principles (EPIC_FAULT)</i>	<b>Planned Starting Semester</b>	Fall 2017

### Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person.

Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

<b>Discipline</b>	<b>Number</b>	<b>Discipline</b>	<b>Number</b>
Mechanical		Electrical	3
Computer	1	Systems	
Other ( )			

### Project Overview:

Addition of renewable energy resources like solar and wind is changing the dynamics of a modern power system. Solar and wind farms are weak power sources with low fault current contribution. The low fault current makes fault detection challenging using conventional phasor-based algorithms. A new fault detection method using traveling waves and incremental quantities is now available in a digital protective relay. This project will evaluate the performance of a traveling wave and incremental quantity based fault detection methods on systems with large ingress of inverter based sources. As a new technology, this project will provide an edge and facilitate the transition of students to the industry.

### Initial Project Requirements:

The project will be in partnership with Schweitzer Engineering Laboratories and EPIC. The objective is to model a weak source power grid model to test the performance of time domain principles for protection and fault location in different scenarios. Students will need to create a power grid model with weak sources (PV farms, etc.) in Electromagnetic Transient (EMT) Program. With the grid model, the students will create fault scenarios to compare the performance



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of the phasor based and time domain principles available in SEL-421 relay and the new SEL-T400L relay respectively.

**Expected Deliverables/Results:**

- Model source power grid in EMT programs
- Develop different fault type and fault location scenarios
- Set up required relay configuration for protecting the test line
- Implement hardware in the loop testing
- Compare the performance of protection and fault location functions in SEL-421 and SEL-T400L

**Disposition of Deliverables at the End of the Project:**

Technical Supporter will take possession of the data/results at the conclusion of the Expo. Copy of the data/results will stay in the Smart Grid Lab for future research/testing development.

**List here any specific skills, requirements, knowledge needed or suggested (If none please state none):**

- Knowledge and understanding of power system fundamentals
- Prior knowledge of EMT programs (Eg: RSCAD), SEL products will be helpful