



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

Senior Design Project Description

Company Name	Southwire Company	Date Submitted	5/4/2018
Project Title	Automation of Electrical Loading and AC Resistance Measurements (SWIRE_AMPS)	Planned Starting Semester	Fall 2018

Personnel

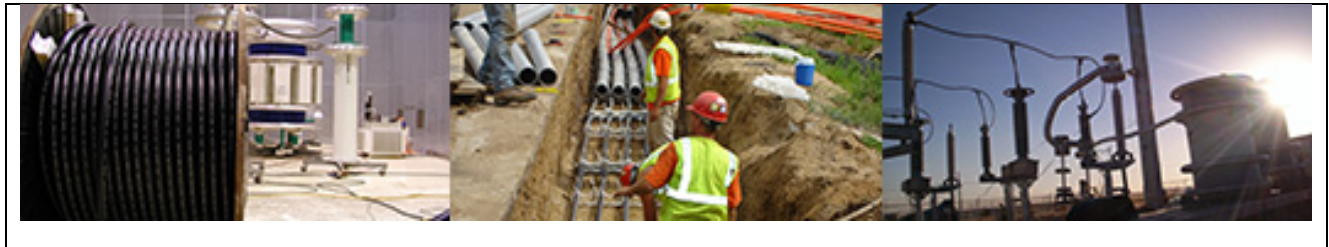
Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person.

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

Discipline	Number	Discipline	Number
Mechanical	2	Electrical	2
Computer	1	Systems	
Other ()			

Company and Project Overview:

Southwire is a manufacturer of wire and cable products. The plant in Huntersville manufactures solid dielectric XLPE power cable up to 500kV (current industry max). Some testing done on the cable requires it undergoes heating and cooling cycles, like those experienced when placed in service. Currently, this is being controlled manually and we would like it to be automated. We would also like to have a test setup created and automated that will inject current into the test object to measure AC resistance. The automated test would obtain a curve for the AC resistance over a temperature range.



Project Requirements:

Currently, we have line service that goes to a Variac that powers current transformers, which induce current in the test object (Typically a power cable). The Variac is controlled manually and needs to be automated with PLC control. For example, a heating cycle may be 8 hours on and 16 hours off, needing to reach 90°C on the conductor within 2 hours. We should have inputs for the



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

number of cycles, cycle on time, cycle off time, rise time to full temperature, and target temperature. This data should also be captured and output to a file. There will need to be provision for measuring the temperature during the automatic control. Following this, a test setup will need to be created for which the AC resistance can be measured at the specific temperature of the conductor. We would like a measurement system to be automated to increase temperature between ambient and full rated conductor temperature to plot a curve of the changing AC resistance shown per unit length. The AC resistance on such a short length on large conductors is difficult to measure and source of noise will need to be carefully mitigated. A test setup should include a connection method to the conductor that does not add much contact resistance, homogeneously injects current, and provides reproducible results.

Expected Deliverables/Results:

- Method of automated control of the Variac to run heat cycles on power cable that accepts specific inputs on the characteristics of the load cycles.
- Output of results from the loading cycles into a final report format, with the ability to export the data to Excel so the cycles can be used in further analysis.
- Build test setup for which a defined length of conductor (approximately 1 meter) can be placed and that will measure the AC resistance of the conductor.
- Automated control of the Variac to produce an AC resistance plot over a temperature range for the test object
- Output of results from the AC resistance measurements into a final report format, with the ability to export the data to Excel so the resistance can be used in further analysis.
- A full owner's manual for the equipment created. This would include, but not be limited to, description of the system, how to operate it, theoretical background, best practices for good results (e.g. how to reduce noise, connect to conductor, etc.), and expected amount of error.

Disposition of Deliverables at the End of the Project:

Provide to the Supporter at the conclusion of Expo

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

- Lab experience would be a plus. PLC programming will be required: for this 1 computer engineer was chosen, but an electrical may be better if they are able to do this.