

## UNC Charlotte – Lee College of Engineering Senior Design Program

### Senior Design Project Description

<b>Company Name</b>	<i>EPRI</i>	<b>Date Submitted</b>	<i>11/15/2019</i>
<b>Project Title</b>	<i>Design of a Proof-of-Concept Non-Destructive Testing Device using the Metal Magnetic Memory Method (EPRI_MAG)</i>	<b>Planned Starting Semester</b>	Spring 2020

#### Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

<b>Discipline</b>	<b>Number</b>	<b>Discipline</b>	<b>Number</b>
Mechanical	1	Electrical	4
Computer		Systems	
Other (multi-disciplinary or systems )			

#### Company and Project Overview:

The Electric Power Research Institute (EPRI) conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally. As an independent, nonprofit organization for the public interest, we focus on electricity generation, delivery, and use in collaboration with the electricity sector, its stakeholders and others to enhance the quality of life by making electric power safe, reliable, affordable, and environmentally responsible.

EPRI has collaborated with the electricity sector and its stakeholders since 1972 and our membership has grown to represent approximately 90% of the electric utility revenue generated in the United States and extends to participation in more than 35 countries. The worldwide membership that supports our work comprises more than 1,000 organizations. While most members are electric utilities, others are businesses, government agencies, regulators and public or private entities engaged in some aspect of the generation, delivery, or use of electricity.

Through their advisory roles in EPRI, its research sectors and programs, EPRI members help inform the development of EPRI's annual research portfolio, identify critical and emerging electricity industry issues, and support the application and technology transfer of EPRI's research and development.



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This project will be related to a relatively new method for conducting Non-Destructive Examination (NDE) testing on ferromagnetic metals.

### **Project Requirements:**

The metal magnetic memory (MMM) method is a passive magnetic nondestructive evaluation (NDE) technique reportedly able to detect stress concentration zones (SCZ) on the surface of ferromagnetic metals. Potential applications include residual stress measurements, early fatigue detection and wall thinning in metal piping.

More information about MMM can be found here:

<http://www.energodiagnostika.com/about-mmm-method.html>

The objective of the project is to design and build a proof of concept MMM manual scanner that measures the magnetic field in three orthogonal directions, including a one-dimensional positional encoder for line scans and basic software for data acquisition, storage, processing and display. The students would need to spec out and design the hardware (encoder, means to measure magnetic field in the 3 directions, etc) and design the software (read and display data, including spatial derivatives, etc). A verification testing protocol would also be developed and implemented.

### **Expected Deliverables/Results:**

- Proof of Concept MMM scanner
- Measures magnetic field in three orthogonal directions
- The scanner should also compute their spatial derivatives based on the encoder readings
- One dimensional positional encoder
- User interface for operator to use the device
- Verification testing of device

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

Delivered to EPRI after the conclusion of the Expo.

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

- ECGR3122 – Electromagnetic Waves
- ECGR3156 – Electromag and Elec Devices Lab