

## 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 Method to Assess Welding Quality using Sound or Vibration</i> <b>(EPRI_WELDS)</b>	<b>Planned Starting Semester</b>	<i>Spring 2020</i>

#### 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	3	Electrical	
Computer	1	Systems	1
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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Power generation equipment use significant amounts of welded material, so the quality of weld joints and how to improve the quality is an important issues. This project will explore techniques to use sound and vibration to assess welding quality for quality assurance and training purposes

### **Project Requirements:**

When welds are made, they emit a sound and vibration. This project will investigate whether sound and vibration can be used to differentiate a good weld from a bad weld.

The project would include setting up a system for monitoring welding processes using sound or vibration monitoring equipment. This would require establishing the protocol for equipment, set up, data collection, and data analyses. For sound, a microphone would be attached or adjacent to the equipment, recording the sound for good conditions (baseline), then altering the process to simulate conditions that would promote defects, then comparing the data to determine what types of defects can be identified. A similar process would be done using vibration. Defects could be porosity, lack of fusion, seam tracking, etc.

The experiments would have to be closely controlled to establish accurate sound “signatures” for good welds, and for each defect category. Comparison of the signatures will then be made to see if weld quality can be determined from the sound profile. The data would then be used to develop machine learning or teaching automated systems to respond to indication that identify defect or irregularities in the weld (real-time). Equipment for sound, vibration, data recording and welding will be available at EPRI labs, and subject matter experts available for direct interaction with students.

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

- Design test set-ups for both sound and vibration experiments
- Run tests for good and defective welds to generate a data set of signatures
- Analyze the signatures to determine if discrimination of good vs. bad is possible and repeatable
- Apply Machine learning or automated teaching tool that can sense a weld (sound or vibration) and provide feedback

### **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):**

- Interest in welding technology
- For System Engineering student, completed or currently taking SEGR 4141 – Engineering Experimental Design