NCUR 2025 Abstract Submission Draft

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Abstract Title: Stator Intermittent Ground Fault Test Instrument – Version 2.0

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Abstract Text ONLY:

Synchronous generators are critical to the stability and reliability of the power grid, making their protection against electrical faults essential for national security. Among the most common faults is the stator single-phase ground fault, which often begins as an intermittent ground fault (IGF). IGFs are characterized by high transient currents and overvoltages that can cause severe damage to insulation and generator components, potentially escalating into more severe faults and resulting in costly repairs and downtime.

To address this challenge, our project aims to develop Version 2.0 of the 87S test instrument, an innovative tool for detecting and analyzing stator IGFs. Building upon the successful deployment of Version 1.0, which has been validated in both laboratory and industrial settings, this project seeks to enhance the instrument's hardware and software capabilities to improve its functionality, durability, and usability in harsh industrial environments.

The primary upgrades include redesigning the electronic circuitry to incorporate a custom power supply, battery management, and improved load switch topology. The Arduino UNO microcontroller (MCU) used in the previous version will be replaced with an STM32 MCU, offering increased processing power and flexibility. Additionally, the enclosure will be redesigned using a combination of extruded aluminum and CNC machined panels to ensure resilience to physical stresses.

Our methodology combines printed circuit board (PCB) design, power system optimization, mechanical enclosure prototyping, and embedded software design. Student researchers will gain hands-on experience in all of the previously mentioned areas.

The expected outcome is a robust and versatile test instrument capable of staging and analyzing IGF events with higher precision and reliability. This tool will enable more effective testing and validation of protection algorithms for synchronous generators, contributing to the prevention of catastrophic faults and enhancing grid security.

Abstract Type: Student Abstract Submission

1st Choice Presentation Format (Student): Poster Presentation

2nd Choice Presentation Format (Student): Oral Presentation

Discipline Area: Engineering

URL (Optional): Maybe put the Github repo here? https://github.com/nicholasnloehrke/87s_research

Primary Presenter: Nicholas Loehrke

Co-Presenters(s) (Optional): Maybe Owen?

Mentor: Nader Safari-Shad

Campus Coordinator: No idea what to put here