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ECE 525

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Lab 3 Report

# Purpose:

This lab was designed to illustrate usage of an RTDS system and RSCAD to test and validate relay settings for a bus protection scheme. Other topics covered illustrated the issues that may arise from CT saturation, cascading faults, and internal/external fault detection.

# Lab Procedure:

As this lab was primarily focused around bus protection and the AMPS lab does effectively support such demonstrations, a simulation with RTDS and an SEL-487B was used. The RTDS could effectively model the bus and related power system while introducing the currents and voltages at a board-level for the SEL relay to interpret. Since setting an RTDS system in RSCAD is beyond the scope of this course and related lab, no overwhelming amount of time was spent in demonstrating the system application.

It was interesting to review the connections made between the RTDS and the SEL relay since they were not true secondary connections, but rather board-level connections introduced as millivolt values for the board circuitry and processor to interpret. As the connections between the relay and simulator are outside of the scope of this lab, they were not delved into any further.

Testing consisted of simulating internal and external faults prior to simulating CT saturation and cascading faults. The internal and external testing demonstrated exactly what could have been expected for such faults in an effective protective system. The SEL-487B responded to internal faults due to the high operate current (with respect to low restraint current) and ignored external faults due to their signature high restraint current (with respect to the low operate current).

Testing with the CT saturation illustrated some more interesting results. For some faults, CT saturation did not pose nearly as significant an issue, however, a few saw major consequences because of the high saturation. In such situations, we saw tripping operations that should not have occurred in an ideal world. Such tripping situations occurred for external faults very near the CT.

# Event Record Analysis:

Here, like in Lab 1 and Lab 2, it was very useful to open an event record and view the results as oscillographic data and make interpretations based on the data. In addition to seeing the information, it was useful to confirm that the oscillography from the relay demonstrated CT saturation in some events.

# Conclusion:

This lab was very useful in understanding the basics of relay settings application and validation. It was interesting to confirm the effects of CT saturation and how such behavior effected the protection scheme in adverse ways. It was also interesting to see the RTDS system operating with the SEL-487B to perform “hardware-in-the-loop” testing.