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Title: “15 Years of Experience With 100% Generator Stator Ground Fault Protection – What Works, What Doesn’t and Why”

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Note: This paper was presented at the Georgia Tech Protective Relaying Conference in 2007 and will be presented at the Western Protective Relay Conference in Oct. 2008.

This paper is written and is available for review upon request.

Abstract:

This paper discusses the experiences of several users with the application of three different 100% stator ground fault protection schemes. Two third-harmonic methods and a low frequency-injection method are discussed. Third-harmonic schemes have been widely applied on generators within the U.S. to provide stator ground fault protection over the entire stator winding. In a number of cases, however, these schemes have been found not to be applicable. In many cases, these shortcomings were discovered during commissioning or when they operated improperly—resulting in a false tripping of the generator. This paper discusses situations in which third-harmonic schemes work, and also the limitations of these schemes, which are not well understood by many relay engineers. It also discusses the use of low-frequency injection scheme along with its limitations.

Specific cases include:

- Commissioning methods for third-harmonic schemes – what works, what doesn’t and why
- Effects of machine load and power factor on third-harmonic schemes
- False operation on large gas turbines using third-harmonic schemes
- False operation of third-harmonic schemes at hydro plants during full load rejection
- Performance of third-harmonic schemes on generators that operate in parallel on a common step-up transformer
- Operations of third-harmonic schemes on cross-compound generators
- Application of third-harmonic schemes on large nuclear plant generators
- Principle of using the low-frequency injection for 100% stator ground fault detection
- Commissioning of low frequency-injection system