IEEE PES Transformers Committee
Fall 2021 Meeting
Online/Virtual

IEEE 693 Power Transformer Amendment: Power Transformer Structural Dynamics Requirement for Seismic Qualification

— Technical Presentation —
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1. Abstract

Power transformers are critical elements of the electric power grid with a complex and time-consuming procurement and installation process. Despite current seismic qualification requirements, numerous power transformer seismic bushing and surge arrester failures have been documented.

The current static analysis method incorrectly assumes the massive oil-filled tank to be "rigid." Based on both analytical and empirical research, the design of the power transformer can cause the bushing and surge arrester loads to be amplified beyond their stand-alone seismic qualification limits. A dynamic analysis requirement will capture higher-than-assumed transformer component amplification caused by the structural dynamics of any power transformer design.

2. Learning Objectives

This tutorial provides the following learning opportunities:

- Overview of the IEEE 693 power transformer amendment under development
- Rationale that led to the amendment

3. Learning Outcomes

By attending this tutorial, attendees will gain an understanding of the following:

- Concerns regarding the use of static analysis for large (>138kV) power transformer designs
- Why dynamic analysis improves seismic qualification
- How power transformer seismic qualification work would change
- How the amendment would impact power transformer bushing and surge arrester seismic qualification

4. Presenters' Biographies

Jon Bender is an engineer and researcher with W.E. Gundy & Associates, Inc., an industry leader in seismic analysis, testing and design. Jon has completed hundreds of T&D seismic analysis/qualification projects, including risk assessment, equipment design consultation and published research. He has been involved with the IEEE 693 committee for the past few years, participates in the EPRI Substation Seismic Studied Group (SSSG) and routinely supports both qualification and research testing at various shake-table labs. Jon received his Master of Science Degree in Civil/Structural Engineering from Boise State University.

Michael Riley is a civil engineer at Bonneville Power Administration working in the Transmission Engineering & Technical Services Policy & Governance Group. With 19 years of experience in the electric power industry, Michael has specialized in structural engineering and seismic engineering during his university studies and throughout most of his electric power industry career, currently managing, facilitating and coordinating the development and maintenance of transmission engineering policies and standards. He is a member of IEEE and the IEEE Standards Association. Michael is chair of IEEE 693, Seismic Design of Substations; vice chair of IEEE 1527, Seismic Design of Flexible Buswork; a member of IEEE 605, AIS Bus Design and ASCE 113, Design of Substation Structures as well as a member of Electric Power Research Institute (EPRI) Substation Seismic Studies Group. Michael received his Bachelor of Science Degree in Civil Engineering and his Master of Science Degree in Civil and Environmental Engineering from Portland State University in Portland, Oregon. He is a professional engineer in the state of Washington.