Transient Analysis in DER Studies

Eversource DER Planning

May 20, 2021

Outline

- Introduction

- Risk of Islanding (ROI)

- Transient Over Voltage (TOV)

- Transient Study Methodology

Introduction

Need for Transient Analysis

- Increase in DER penetration requires the need to conduct transient analysis to maintain the safety and reliability of the distribution system

Types of Analysis

- Risk of Islanding (ROI)
- Transient Over Voltage (TOV)

Standard

- IEEE 1547-2018

Software

- Transient studies are conducted using Electromagnetic Transient Software (EMT) like PSCAD, EMTP-RV, and ATP

Study Complexity and Timing

- PSCAD model development, troubleshooting, and analysis are complex and time consuming

Risk of Islanding (ROI)

- Unintentional island formation can happen when feeder breaker/recloser trips with DG energizing the load in the circuit

- Unintentional islanding can pose safety concerns and damage to EPS equipment

- DER penetration could lead to active and reactive power match, which could hinder the island detection and tripping of the inverters

- The DER shall trip within 2 seconds of the island formation (Refer to IEEE 1547-2018 Section 8.1)

Transdient Over Voltage (TOV)

- Transient Over Voltages are very high voltage for a short period of time

- When the source is lost, a brief islanding scenario can occur with DERs still generating that will increase the voltage due to the excess energy within the island

- High Generation to Load ratio could cause reverse flow and TOV risk under loss of the source

- Over Voltages Studied:

  – Load Rejection Over Voltage (LROV): Transient Over Voltages caused due to opening of an upstream protection device in an island

  – Ground Fault Over Voltage (GFOV): Over Voltages caused due to single-phase to ground fault in an island

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IEEE 1547-2018 TOV Standard

- Refer to IEEE 1547-2018 Section 7.4.2 for TOV Standard

- The DER shall not cause the instantaneous voltage on any portion of the Area EPS to exceed the magnitudes and cumulative durations shown in the Figure

Figure 3 —Transient overvoltage limits
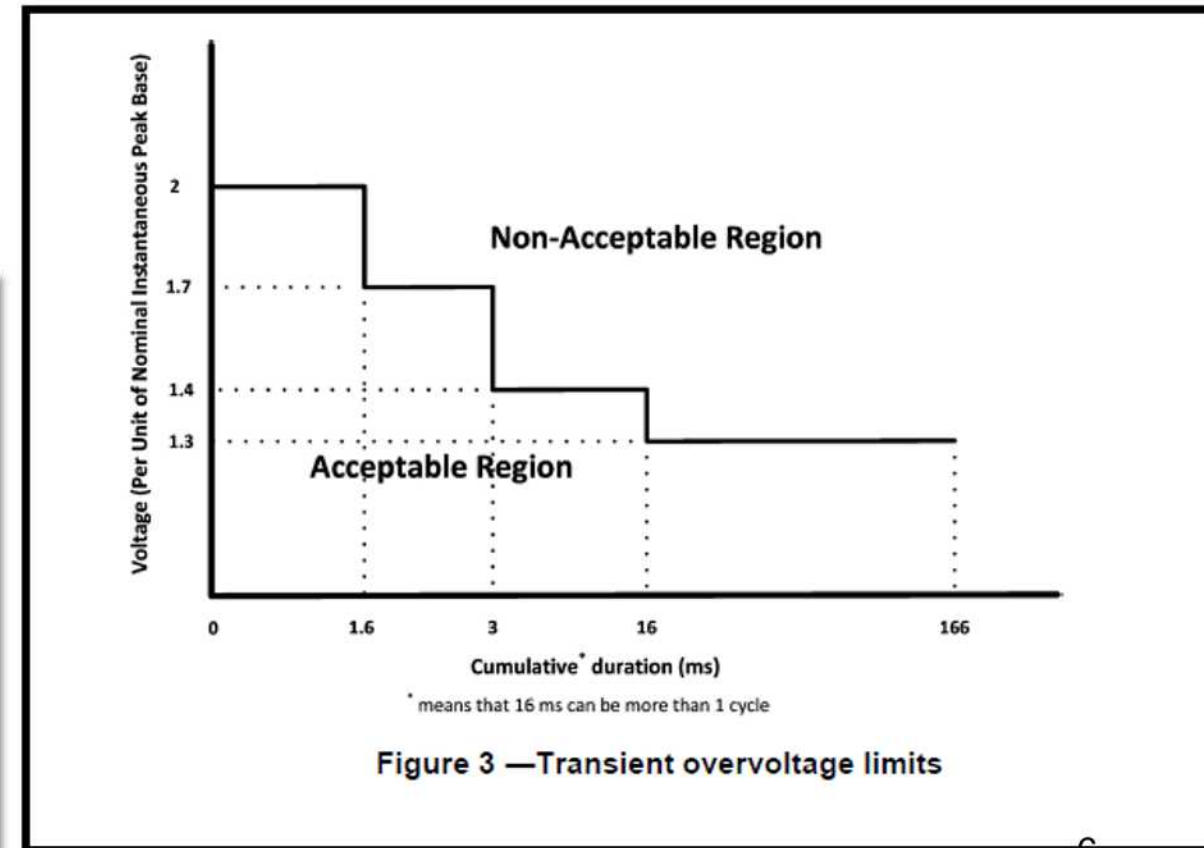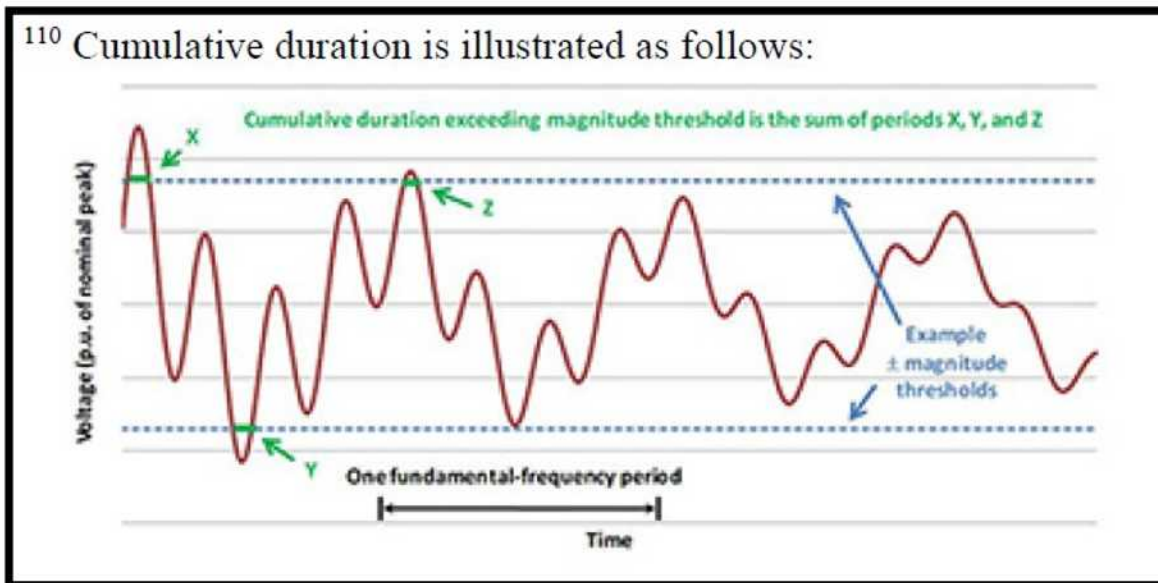
Transiet Study Methodology

| Data Extraction from Steady State Model (Synergi) | EMT Software (PSCAD) Model Development | Customer Provided PSCAD Model Review | ROI & TOV Analysis | Mitigations | Study Report |

Questions