Comparing and Contrasting Power Flow and Short Circuit Sequence Data

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Agenda

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- Assumptions Baked into Cases
- Changes are Afoot
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Introduction

- Creating coordinated base cases for studies is achieved by using two basic tenants:
  - Process to coordinate the data
  - Data compatibility
- Both are needed to successfully build coordinated base cases
- WECC has made strides with both for the power flow and transient stability
  - The process to coordinate the data is govern by the Data Preparation Manual (DPM) which is a living document
  - The data compatibility issues has been worked on / are still being worked on by WECC and the software vendors and MVWG
- So the question become, why can't power flow and dynamic data be imported into sequence data cases?

Use Assumptions

Power Flow & Transient Stability Uses	Short Circuit Sequence Data Uses
• Determine the thermal and voltage limits of the system depending on the load and generation mix • Determine if the system can recover within criteria after disturbances	• Determine the fault duty to size equipment such as breakers and bus equipment • Determine and coordinate the relay settings for line and bus protection

Assumptions Baked into Cases

Power Flow & Transient Stability	Short Circuit Sequence Data
• Line impedances would be assumed to be “long” to contribute to instability of the system	• Line impedances would be assumed to be “short” to contribute to worst case SCD
• Generation will balance the load so not all will be online but will be offline to prevent extraneous issues	• All generators are assumed online at the same time to contribute to the SCD= not necessarily a valid power flow case
• Models the entire WECC system because voltage and thermal issues can travel all through WECC	• SCD doesn’t travel very far (localized area) = Equivalent system used outside of study area
• Loads are important which dictates the scenario being studied	• Loads don’t contribute to SCD
• Network topology is modeled a certain way to simplify the amount of buses needed (more details doesn’t yield better results)	• Network topology is modeled in a certain way to facilitate relay settings and breaker evaluation (detection and tripping)
• Voltage bases are of no real consequence because the initial and final voltages will be solved by power flow	• Voltage bases could be different depending on operating voltages and are important to determine SCD

Changes are Afoot

- There is a paradigm shift happening now:
  - Coordinated cases are becoming more important due to the uncertainties of clearing faults that are not at their maximum
  - More interconnections (generation and otherwise) are connecting at the seams between utilities
  - Capturing issues associated with cascading faults that can happen due to miscoordination of relays between utilities

- High short circuit duty is starting to become less of an issue as renewable generation goes online and conventional generation retires

The Good (Data that is the Same)

The Good (Data that is the Same or Similar)

- Bus Data
- Branch Data (positive sequence)
- Two Winding Transformer Data (positive sequence)
- Three Winding Transformer Data (positive sequence)
- Synchronous Machine Data (positive sequence)
- Area Data
- Zone Data
- Owner Data

The Bad (Data that is Different)

The Bad (Data that is there but Different)

- Bus Number Primary Key (Aspen uses Bus Name & Bus kV)
- kV base (500 vs. 525, 220 vs. 230, etc.)
- Phase Shifter Data (zero sequence and categorization)
- Network Topology for the same transmission assets
- Generation and connected equipment status
- Area and Zone data

The Ugly (Data that is Missing)

The Ugly (Data or Settings that is missing)

- Branch Data (zero sequence)
- Mutual Coupling (zero sequence)
- Two Winding Transformer Data (zero sequence)
- Three Winding Transformer Data (zero sequence)
- Transformer Winding Configuration
- Synchronous Machine Data (zero sequence)
- DC Lines (converters and DC lines)
- Type 3 and Type 4 Generator Specific Models
- Breaker Information
- Series Compensated Protection
- Bus Tie
- Manufacturer Based Relay Logic
- Shunt Devices (Fixed and Switching) (zero sequence)
- Data Maintainer

Questions / Comments