IEEE 342-Node Low Voltage Networked Test System

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Overview

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Why this Test Feeder is Needed

The LVNTS has been designed to present challenges to distribution system analysis software in the following areas:

- Heavily meshed and networked systems.
- Systems with numerous parallel transformers
- Modeling of parallel low voltage cables

Brief History of Low Voltage Networks

- The early low voltage systems were DC, but because of load growth these could not meet demand.
- One of the fist low voltage AC networks was in Peoria Illinois in 1915. Expansion proved expensive because of the need for additional feeders to offset the large voltage drops at the systems edges.
- In 1921 the Puget Sound Power & Light Company deployed a meshed secondary system in Seattle Washington. (Manual network protectors)
- In 1922 the United Electric Light & Power Company of New York energized the first modern AC low voltage network. (Automated network protectors)
- Soon after 1922 it was shown that that a higher medium voltage AC primary, with low voltage network secondary, would be the most cost effective system.
- Numerous secondary voltages were used, with the most common being 208/120V and 199/115V.

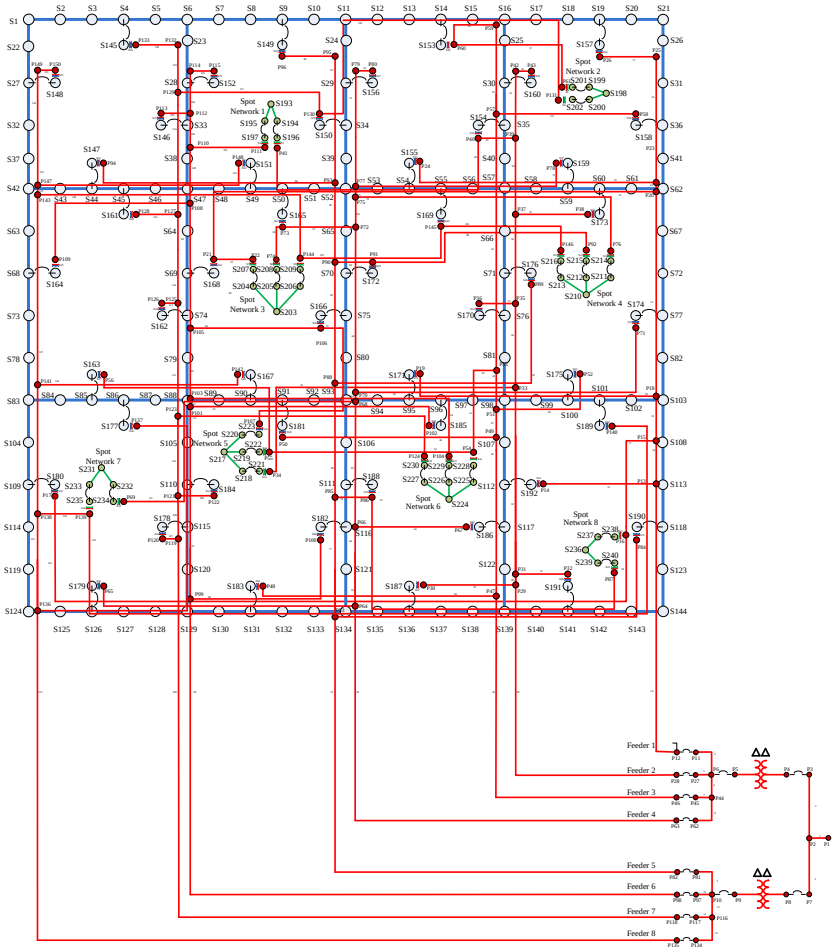
Modern Low Voltage Networks

- The 1922 the United Electric Light & Power Company of New York low voltage system was one of the first modern systems.
  - Automatic network protectors
  - Parallel transformers
- Multiple feeders supply grid networks and spot networks.
- Grid networks are normally 120/208V
- Spot networks are normally 277/480V
- Secondary networks use parallel sets of conductors to carry the high current levels.
- Reliability on these systems is very high.
- Fault currents are also very high because of the low system impendences.

Overview of 342-Node Low Voltage Network Test System

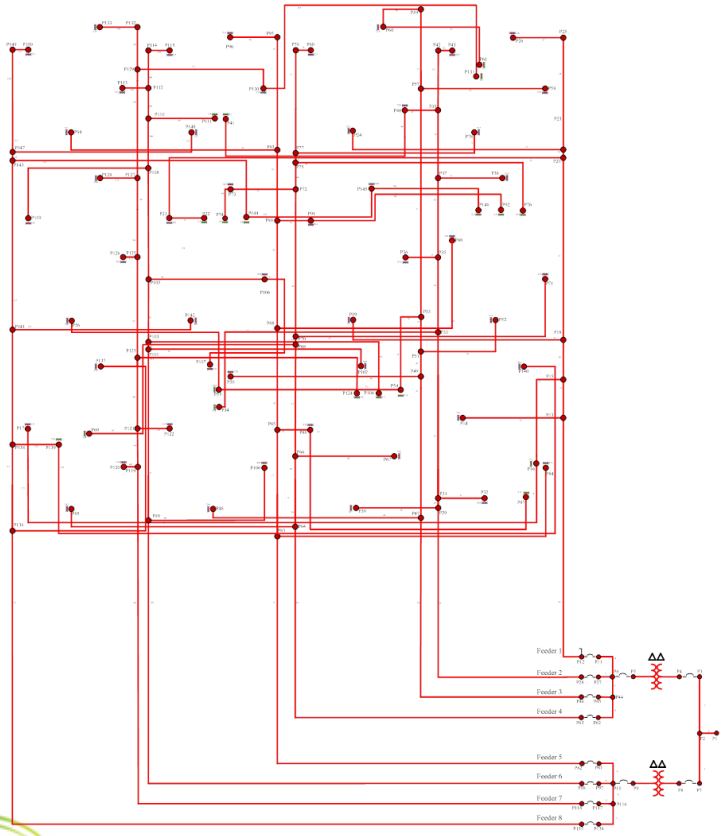
- 2 delta-delta step down transformers (50 MVA)
- 8 13.2 kV distribution feeders
- 48 grid network transformers (1 MVA)
- 20 spot network transforms (1.5-2.5 MVA)
- 1 120/208V grid network
- 8 277/480 V spot networks

- Primary Cables: 1000 kcmil AA
- Secondary Cables: 500 kcmil CUX6

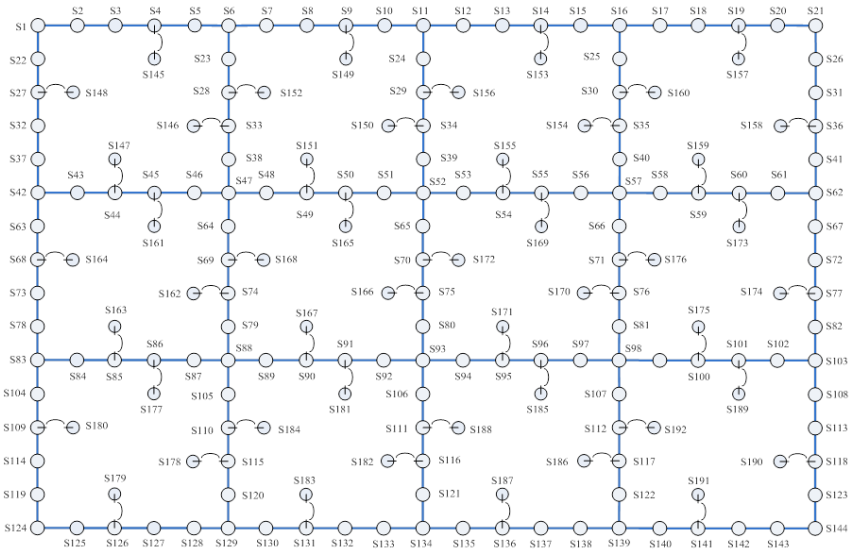


Primary and Secondary System Layouts

Primary System



Secondary Low Voltage Grid

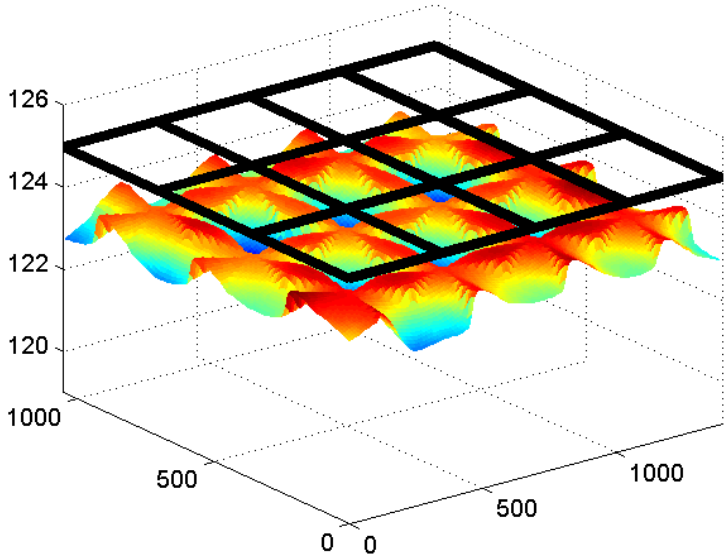


Power Flow Solutions for the 342-Node System

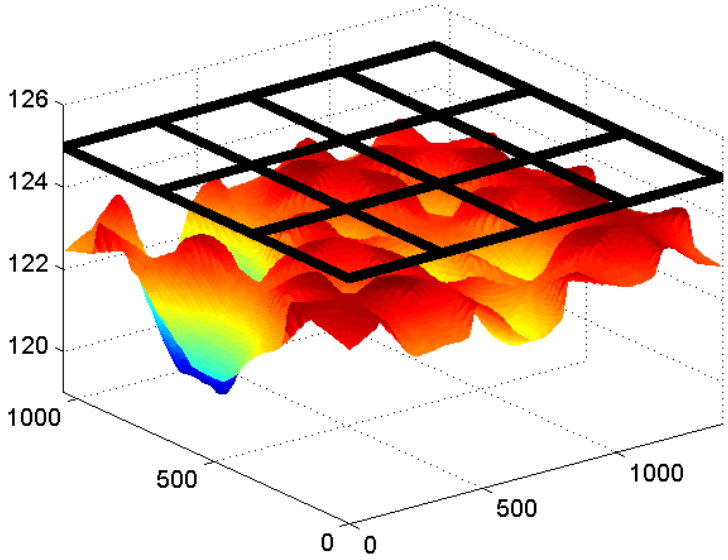
- With all network components in operation the voltage drop on the system is very low.
- This is due to two factors
  - First, the system is networked
  - Second, the secondary network uses parallel sets of cables
- Even with components out of service, the voltage will remain within ANCI C84.1.

Voltage Magnitude Heat Maps

All Feeders In Service



Feeder 6 Out of Service



Concluding Comments

- The 342-Node Low Voltage Networked Test System is the first heavily meshed system to be developed by the DSA Test Feeder Working Group.

- This system is representative of a low voltage network and is meant to introduce many new concepts to the analysis community.

- This system is the first of two intended systems. A second more complicated system is planned.