Phase Connectivity Identification In Electric Power Distribution System With Smart Meter Data

Tech ID: 32636 / UC Case 2017-051-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,740,274	08/29/2023	2017-051

FULL DESCRIPTION

Background

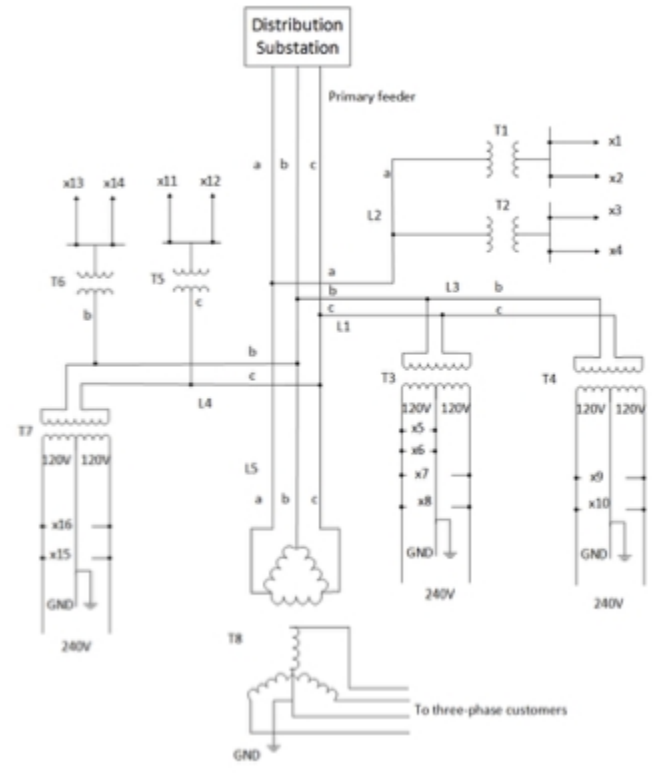
Accurate network and phase connectivity models are crucial to distribution system analytics, operations, and planning. This important to fully derive the benefits of distributed energy resources and for active management of the distribution network. Although, network connectivity information is mostly reliable, phase connectivity data is typically missing or erroneous. There are two general approaches for addressing the phase identification challenge.

The drawbacks with these existing approaches are:

- Computationally intensive and time consuming;
- Low tolerance to erroneous or missing measurements; Or,
- Require capital expensive systems and maintenance costs for additional equipment.

Current Invention

UCR faculty, Prof. Nanpeng Yu and his team, has developed an innovative phase identification algorithm by clustering smart meter data. Using data science methods such as Principal Component Analysis (PCA) and k-means clustering they partition customers into clusters. By solving a minimization problem on these clusters, they are able to accurately identify the phase of each cluster.



Sample illustration of a distribution system

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OTHER INFORMATION

KEYWORDS

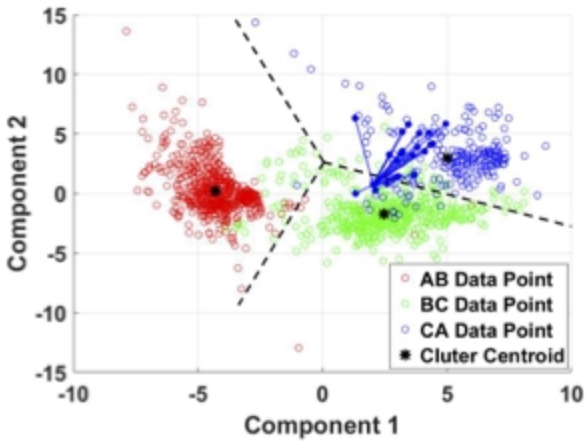
Big data, Distributed energy resources, Power distribution system, Data mining, Smart grid, Smart meter, k-means clustering, Principal component analysis

CATEGORIZED AS

- **Computer**
  - Software
- **Energy**
  - Transmission
- **Engineering**
  - Engineering

RELATED CASES

2017-051-0



Example of the clustered voltage distribution data

ADVANTAGES

The uniqueness or novelty of their approach is:

- The utilization of the known information about line configurations thereby avoiding mislabeling of the customers on the same secondary feeder which can occur in the existing methods.
- The proposed phase identification algorithm is computationally efficient and more accurate.
- The proposed phase identification algorithm is less expensive.

SUGGESTED USES

- Power engineering and smart grid.
- Big data methods in electric power distribution system management.

RELATED MATERIALS

- Phase Identification in Electric Power Distribution Systems by Clustering of Smart Meter Data - Presented at the 15TH IEEE INTERNATIONAL CONFERENCE ON MACHINE LEARNING AND APPLICATIONS

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