

# OPTIMAL RELAY PERFORMANCE USING ADVANCED FAULT DIAGNOSTIC TECHNIQUES

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## Abstract:

This paper describes application of Artificial Intelligence (AI) methods in the diagnostic operation of the protective relays in power system with a particular emphasis on neuro-fuzzy method. It will rather not replace the latter but serve as a means of improving its reliability, as a protection scheme. This work can also be applied to any other complex power system spread over a wide geographical area like Nigeria's.

**Key words:** relay, neuro-fuzzy, fault, protection,

## 1. Introduction:

The protective relay [1, 2] is arguably the most important component in the electrical power system (EPS) for ensuring the reliability and security of system operation. Figure 1 below shows a typical protective relay position and configuration of a section of the Nigeria's Electric Power System.

For some time now, the fault diagnostic mechanism employs a combination of the application of voltage/potential transformers (VT/PT), current transformers (CT) and the protective relay which serves the purpose of detecting abnormal conditions and initiating circuit breaker's action to isolate a faulty portion and/or components in the system.

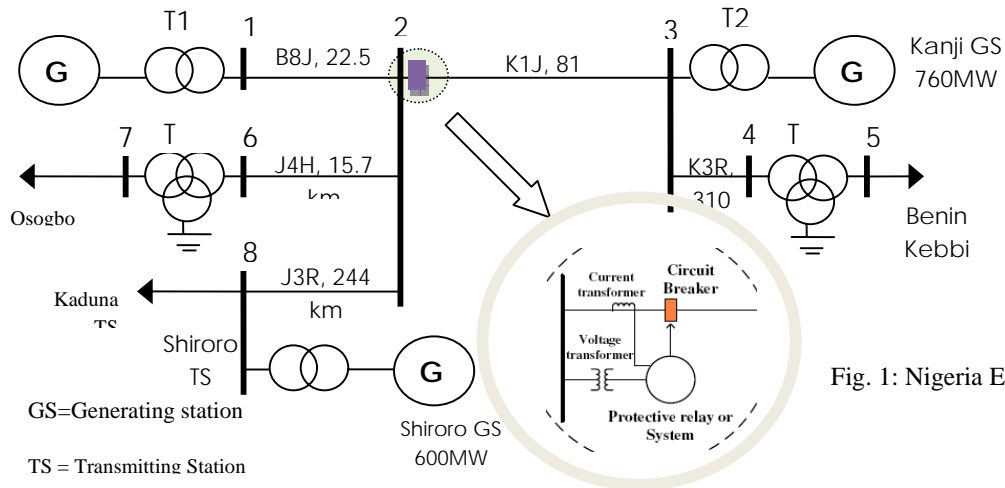


Fig. 1: Nigeria EPS

There are two categories of fault diagnosis systems namely: hardware redundancy or analytical redundancy [3, 4].

This paper is organized as follows: Section 2 recaps the relay fault . Section 3 addresses solution approach .Then lastly the method is applied to a selected model of the practical power network. While the conclusion is drawn from the results obtained.

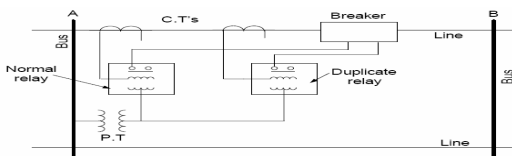


Fig. 2: hardware redundancy with Relay set-up

## 2. Problem Formulation

There are four different types of fault in power systems which can be resolved using reduced circuit analysis [1,3,5].

### 3. Solution Approach

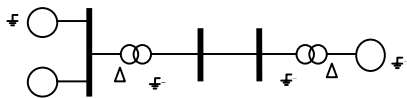


Fig. 3: Single Phase Fault

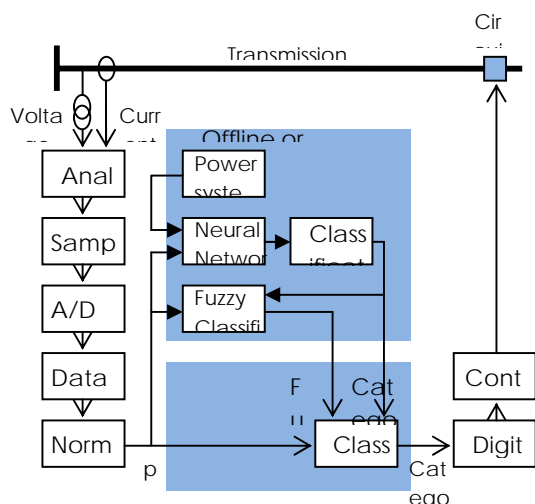


Figure 4: Propose protective relaying based on Neuro-fuzzy

### 4. Test Results

12 values of fault inception angle and 5 values of fault resistance generating were used.

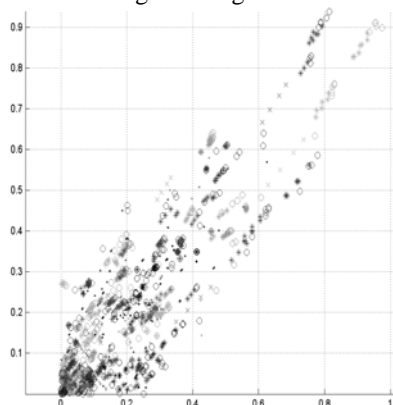


Figure 5: Initial training patterns

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Figure 6: Supervised and unsupervised learning

Most of the patterns are grouped into clusters, although some patterns lie outside clusters. Error in detection can be determined during nominal and varying frequency scenarios respectively. However, source variations take a larger toll on the networks resulting in more predictive errors which could be further improved with stringent error margins.

### 5. Conclusion

The study presents a unique artificial intelligence based solution for high-speed protective relaying.

This work has led the drive for substation automation which allows for on-line control and monitoring of primary and secondary equipment. Future work will be comparing this approach with the existing techniques.

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