

Novel rule base development from IED-resident big data for protective relay analysis expert system

ABSTRACT

Many Expert Systems for intelligent electronic device (IED) performance analyses such as those for protective relays have been developed to ascertain operations, maximize availability, and subsequently minimize misoperation risks. However, manual handling of overwhelming volume of relay resident big data and heavy dependence on the protection experts' contrasting knowledge and inundating relay manuals have hindered the maintenance of the Expert Systems. Thus, the objective of this chapter is to study the design of an Expert System called Protective Relay Analysis System (PRAY), which is imbedded with a rule base construction module. This module is to provide the facility of intelligently maintaining the knowledge base of PRAY through the prior discovery of relay operations (association) rules from a novel integrated data mining approach of Rough-Set-Genetic-Algorithm-based rule discovery and Rule Quality Measure. The developed PRAY runs its relay analysis by, first, validating whether a protective relay under test operates correctly as expected by way of comparison between hypothesized and actual relay behavior. In the case of relay maloperations or misoperations, it diagnoses presented symptoms by identifying their causes. This study illustrates how, with the prior hybrid-data-mining-based knowledge base maintenance of an Expert System, regular and rigorous analyses of protective relay performances carried out by power utility entities can be conveniently achieved.

Keyword: Association rule; Data mining; Digital protective relay; Expert system; Power system protection analysis; Rough set theory