

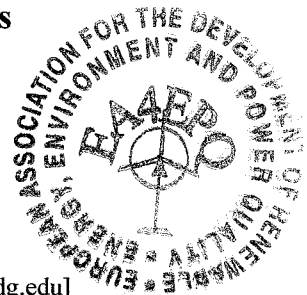
Fault simulation environment for power distribution networks with protection operation

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Abstract. Nowadays research and development of power networks towards a new, more intelligent and self-management infrastructure is a topic of great interest, becoming what is known as Smart Grids. In order to achieve all this, programming tools to deal with large volumes of information are required, to model and simulate these future networks.

This paper presents a tool that allows to model distribution power lines from the information contained in a database, being flexible to the changes that can occur in the line. The developed tool has been tested, in simulation of real cases that correspond to sequence of events due to faults and the actions of the protection system (opening and reclosing) to isolate the fault.

Key words

Fault Location, Power Quality Monitoring, Power Distribution, Protection Coordination.

1. Introduction

Power networks are in a process of redefinition and transformation to become what is known as Smart Grids. These networks will be much more flexible and with enhanced features for an efficient integration of distributed generation (renewable, cogeneration...), active management of demand, the integration of energy storage solutions and management of mobile loads (electric car) [1]-[3].

For all this, new communications and software architectures with higher computing capacity and capable of managing large volumes of information to model, predict and optimize their exploitation and to ensure the quality and efficiency of supply will be required. It implies that great effort in research has to be done in the following years in this topic [3].

The present paper proposes a software tool for automatic generation of models of distribution power lines based on information extracted from a database. The idea is that any change in the network (topology, loads, distributed generation, protective actions, etc.), being reported to the DB, could be automatically upgraded into a network model ready for simulation. This environment has been

tested to simulate real faults with the corresponding protection actions.

2. Automatic modeling of distribution lines

The main goal is to create an application able to generate automatically a model of distribution power line using Matlab/Simulink starting from information of electrical parameters collected in a data base, such as line sections, nodes, generators, loads and protections.

Each line section is modeled using a concentrated parameters model that consists of a series resistance and a reactance as shown in Fig. 1.

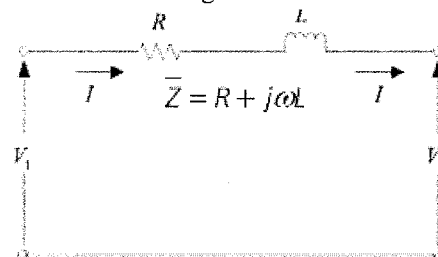


Fig. 1. Line model used.

The line model is automatically generated from the DB, which means that the model can accept modifications to test specific scenarios such as the addition/removal of new line sections or the connection/disconnection of distributed generators to the network. This condition is linked with the definition of Smart Grid.

The model includes the protection elements to simulate transients occurring during the actuation of these elements when a fault occurs.

A data structure used, consisting in a n-Ary tree, has been used to represent the topology of the network. This data structure consists of a hierarchical and recursive ordination of sub-trees containing the line segments connected in a node. This type of structure is also advantageous because the distribution power systems tend to be radial and thus reduce the complexity of representation, the route to the tree is simple using