Fault diagnosis system for tapped power transmission lines

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Abstract

This paper presents a design for a fault diagnosis system (FDS) for tapped HV/EHV power transmission lines. These lines have two different protection zones. The proposed approach reduces the cost and the complexity of the FDS for these types of lines. The FDS consists basically of fifteen artificial neural networks (ANNs). The FDS basic objectives are mainly: (1) the detection of the system fault; (2) the localization of the faulted zone; (3) the classification of the fault type; and finally (4) the identification of the faulted phase. This FDS is structured in a three hierarchical levels. In the first level, a preprocessing unit to the input data is performed. An ANN, in the second level, is designed in order to detect and zone localize the line faults. In the third level, two zone diagnosis systems (ZDS) are designed. Each ZDS is dedicated to one zone and consists of seven parallel-cascaded ANN's. Four-parallel ANN's are designed in order to achieve the fault type classification. While, the other three cascaded ANN's are designed mainly for the selection of the faulted phase. A smoothing unit is also configured to smooth out the output response of the proposed FDS.

The proposed FDS is designed and evaluated using the local measurements of the three-phase voltage and current samples acquired at only one side. The sampling rate was taken 16 samples per cycle of the power frequency. Data window of 4 samples was utilized. These samples were generated using the EMTP simulation program, applied to the High-Dam/Cairo 500 kV tapped transmission line. All possible shunt fault types were considered. The effect of fault location and fault incipience time were also included. Moreover, the effect of load and capacitor switchings on the FDS performance was investigated. Testing results have proved the capability as well as the effectiveness of the proposed FDS.

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