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PD Localization Algorithm Based on Received Signal Strength

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The term partial discharge (PD) refers to electrical breakdown in part of an insulator subject to high voltage (HV) stresses bridging two conductors. The discharge occurs initially in a small region of degraded insulation and does not bridge the two conductors completely. If left unaddressed, the region in which the breakdown occurs may grow until total discharge (flashover) occurs between the conductors resulting in catastrophic equipment failure.

Radiated energy from PD processes can be detected by a spatially dispersed set of broadband radio receivers. The signal strengths measured by such receivers contain information about the location of the PD. Initial progress in the development of a signal strength based localization algorithm for use in the monitoring of PD is presented here. A basic flowchart is shown in Figure 1.

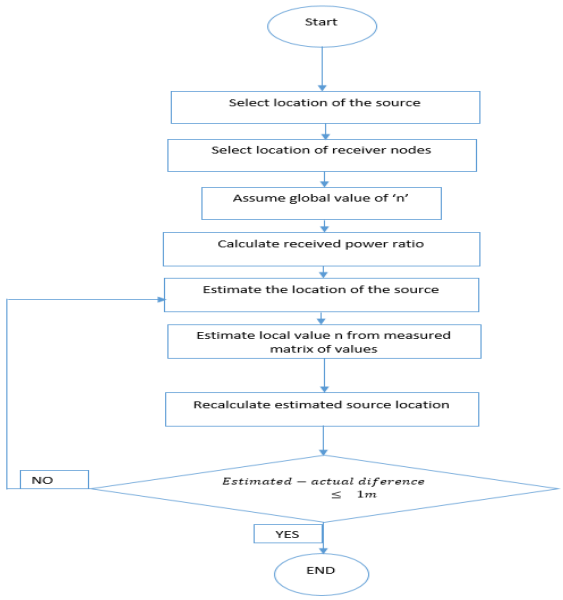

Fig. 1 Basic algorithm

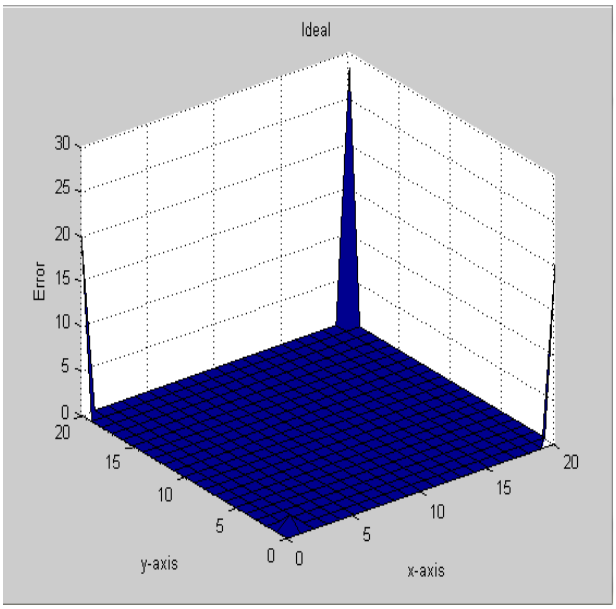

Fig. 2 Error in noiseless simulation

The received signal level is assumed to be modeled by:

$$R_i = R_S - 10n\log_{10}\left(\frac{d_i}{d_0}\right)$$

where R_i is the signal strength by the i^{th} receiving node, n is the (unknown) path loss index, d_i is the distance to the i^{th} node (to be found), d_0 is a reference distance and R_S is the (unknown) radiated power of the PD source. Figure 2 shows location error as a function of actual PD location as found by (noiseless) simulation. The work reported will explain (i) further algorithm detail, (ii) the origin of the error in Figure 2 and (iii) more realistic simulation results.