iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** III **Month of publication:** March 2023

DOI: https://doi.org/10.22214/ijraset.2023.49372

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue III Mar 2023- Available at www.ijraset.com

A Research on Modeling of High Impedance Fault Detection for Protection of Dc Distribution System

Prof. Saniya Khan
Professor, Guru Nanak Institute of Engineering And Technology , MaharashtraDepartment of Electrical Engineering

Abstract: ***High ohmic resistance faults area unit troublesome to find by standard overcurrent relays principally thanks to their low current magnitudes. This paper describes a model for representing high ohmic resistance faults in electrical distribution systems. The model is predicated in a very non-linear resistance representing the high ohmic resistance path throughout this sort of faults. Supported this model, the performance of many electrical variables associated to high ohmic resistance faults is analyzed and an algorithmic rule for top ohmic resistance fault detection in electrical distribution systems is given. Field activity and pc simulations validate the high ohmic resistance fault model and therefore the projected fault detection algorithmic rule. A high ohmic resistance fault (HIF) is generated once an energized conductor (of a primary feeder) makes contact with the bottom or with neighboring objects like branch trees, overgrown vegetation, building walls, asphalt, any object to ground. Such faults area unit undetectable by standard overcurrent devices like overcurrent relays and fuses as a result of their low current magnitude. What is more, arcing accompanies high ohmic resistance faults (hifs) and represents a risk of security to folks and injury to physical infrastructure. Thus, so as to get a trustworthy detection algorithmic rule, it's necessary to possess a reliable high ohmic resistance fault model. This paper presents an analysis of the HIF trial run results and a technique for modeling hifs by considering one nonlinear resistance to represent the fault.***

Keyword: High impedance fault, Principal Component Analysis, Support vector machines

I. INTRODUCTION

High electrical phenomenon fault (HIF) detection represents a true challenge to protection engineers in electrical utilities owing to the complexity and variability of the phenomena concerned. Hifs have the characteristic of manufacturing low current magnitudes compared to nominal load currents, that makes difficult its detection by conventional over current relays in a very reliable manner [1,2]. Some additional options that impudence HIF detection are atmospheric condition, fault conditions, fault distance, short-circuit rate, conductor kindest.

There exist several causes resulting in hifs in Electrical Distribution Systems (EDS). As an example, a HIF might occur once an energized conductor makes contact with the soil surface while not solid grounding, or once the conductor get connected with a branch tree or the other object representing a high electrical phenomenon path to ground. Underneath these circumstances, the comparatively high voltages close to masses and therefore the discharge associated to hifs rep-resents a heavy risk to public safety and a serious concern on industrial installations. The matter of HIF detection has long been recognized by the industry and a number of other techniques are planned within the literature. In 1988, Huang et al. evaluated the performance of 4 different algorithms for HIF detection employing a staged fault check [5]. The evaluations were done off-line and therefore the results incontestable that, under bound circumstances, some algorithms perform higher than others. Latter, in the 90s, Emmanuel et al. Administered extensive measurements of harmonic currents at a ‘‘staged ground impedance fault in sandy soil’’. The aim was to assess to what extent harmonic currents are often used for HIF detection [6]. In 1997, Zori et al.[7] developed an algorithmic program for arcing fault detection using the bus voltages and therefore the odd harmonics.

The most contribution of this paper is that the development of general purpose model for representing hifs of various characteristics in EDS based mostly in a very single non-linear resistance. A second contribution is that the development of an algorithmic program for HIF detection in EDS.

In order to attain these objectives, the paper has been organized as follows: within the second section, the results of many tests are conferred. Supported these measurements, within the third sectional model for representing hifs is planned. The model relies in calculating a non- linear resistance representing the high impedance path associated to the fault. This section additionally includes a methodology for calculative the model parameters. Within the fourth section, an algorithmic program for HIF detection in EDS is conferred and tested. Finally, the paper conclusions are drawn.

It ought to be mention that the HIF model and therefore the HIF detection algorithmic program were implemented within the MODELS section of the choice transient program (ATP) [1] for validation functions. The event of an algorithmic program for HIF detection needs suitable illustration for the high electrical phenomenon existing throughout this kind of events. The set of measurements conferred within the previous section recommend a robust non-linear resistive element for representing hifs. Specially, this paper proposes a model based mostly in a single non-linear resistance. This element would represent the high electrical phenomenon path because of the electrical arc associated to hifs and additionally the comepath through ground and the other contact object sort of a branch tree, as an example. For a given fault, the electrical parameters for this non-linear resistance are often calculated from measurements. Since every activity is exclusive, then the models parameters can vary in a very bound vary. The model development and the calculation of those parameters are currently self-addressed.

II. REVIEW OF LITERATURE

1) *S. H. Mortazavi, z. Moravej and s. M. Shahrtash, "a hybrid method for arcing faults detection in large distribution networks", international journal of electrical power & energy systems, elsevier, vol. 94, no.16, (2018) january, pp. 141-150.*

Fault location in an unbalanced multi-lateral distribution network having many branches, laterals, load faucets and distributed generation may be a major challenge. Just in case of multi-lateral distribution network, the fault location theme must accurately find the faulted line section to avoid the matter of multiple fault location candidates. Ancient fault location schemes in such network employs extra measures to separate out the precise fault location outof the multiple candidates. To beat the higher than mentioned downside, a brand new hybrid methodology combining high-frequency transient methodology and electrical phenomenon primarily based methodology is planned during this work for fault location in an exceedingly unbalacened multi-lateral distribution network. This methodology 1st identifies the road section with fault then the electrical phenomenon primarily based methodology is employed to find the precise fault location. The simulation results obtained demonstrate that the planned theme for fault location is capable of locating all shunt fault sort with sensible accuracy.

2) *Z. Liang "high impedance fault detection in power distribution systems with impedance-based methods in frequency domain", ph.d. Thesis, sun yat-sen university, (2016) october.*

The power systems are complicated and not continuously simple to grasp. Currently a days distributed generation (dg) supported renewable energy resources registered associate degree exponential progress inspired by the policy manufacturers, world issues concerning co a pair of emissions, energy shortage, and anxiety for clean strength generation. This results in a fast and constant upgrading of improvement during this explicit region, conveyance these systems at a degree wherever their unwavering quality and fitness is no longer examined. The best challenge for electrical engineers is to produce a more robust protection theme to notice the high electrical phenomenon faults (hifs). Hif conventionally happen once the first conductor makes unwanted contact with a rod surface, sod, tree limb, that restricts the flow of fault current to grade beneath that systematically detectable by standard overcurrent devices. A unique and economical protection theme have to be compelled to able to notice the hifs and which might operate facility adequately, and protects the instrumentation still because the public from dangerous over voltages. This paper pursues is to analysis of literature associated to hif look. During this work, mathematical logic technique used for hif detection square measure assessed. The projected hif model offers a lot of actual and consistent compared toalternative ways.

3) *M. F. Akorede, "Wavelet Transform Based Algorithm for High- Impedance Faults Detection in Distribution Feeders", European Journal of Scientific Research, vol. 20, no. 2, (2010) September, pp. 237- 247.*

A novel methodology for top electrical resistance fault (HIF) detection supported pattern recognition systems is given in this paper. Using this methodology, hifs are often discriminated from insulator discharge current (ILC) and transients like capacitor switching, load switch (high/low voltage), ground fault, inrush current and no water level switch. Rippling rework is employed for the decomposition of signals and have extraction, feature selection is finished by principal part analysis and Bayes used for classification. HIF and ILC information was no heritable from experimental tests and also the information for transients was obtained by simulation using EMTP program. Results show that the proposed procedure is efficient in characteristic hifs from different events

III. METHODOLOGY

Modeling of HIF for electrical distribution networks in figure shown below. Linear HIF model to review hifs, a primary approximation considering a pure resistance was at the start used. This can be a questionable assumption asa result of the spatiality of the fault currents were neglected [19].

However, this model was adopted for the analysis of this subject. The most disadvantage of this model is that top ohmic resistance faults is also mistaken for load currents. Therefore, transient elements might facilitate improve the HIF detection and can have a major impact on the quantityof HIF detection. 2.2. Diodes-based model one amongst the primary models accustomed study hifs in electrical distribution systems was rumored in 1990 [2]. This model was developed from measurements recorded in a very 13.8 kv distribution feeder, wherever the conductor was touching the sandy soil. This has become the foremost widespread model. Fig. One shows a simplified model supported 2 diodes and 2 d.c. Voltage sources connected in parallel to get the most characteristics of a HIF. Fig. 2(a) and (b) show a typical HIF wave using a diodes-based model, wherever thisspatiality and therefore the non-linear of voltagc-currcnt (V-I) characteristics arc discovcrcd.

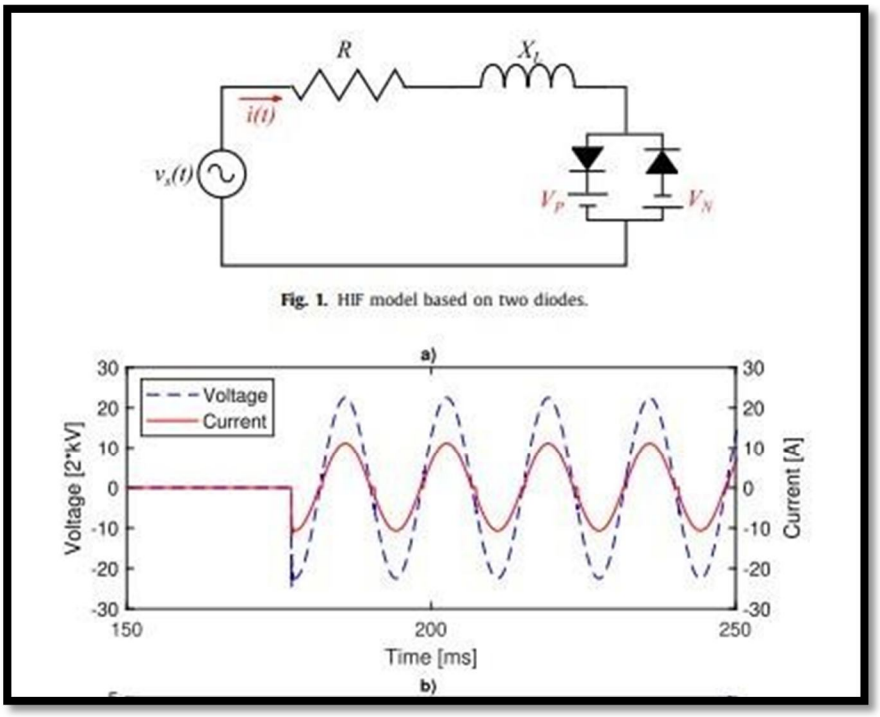


Fig. 1. HIF model based on two diodes.

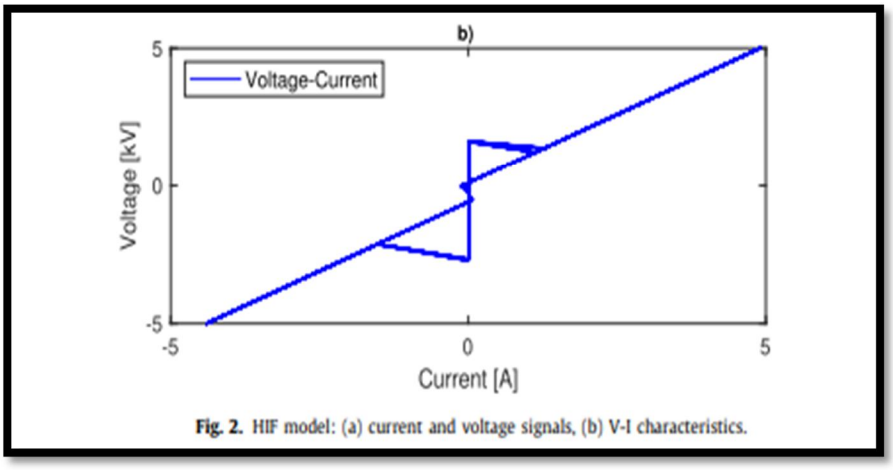


Fig. 2. HIF model: (a) current and voltage signals, (b) V-I characteristics.

Current or each current and voltage waveforms as input options for HIF detection. throughout HIF because the increase of current with respect to the pre-fault current is incredibly less (in this study it's kept < 5%), the distortions and irregularities within the current waveform at the relay location is insignificant that is clearly evident from Fig. 5(a). However, the voltage waveforms area unit less addicted to pre-fault loading conditions. HIFs area unit principally single-line-to-ground sort. Occurrences of such faults introduce unbalance into the system and maymanufacture vital percentage of residual current with regard to the positive sequence current just in case of a grounded distribution system.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue III Mar 2023- Available at www.ijraset.com

However, vital share of residual voltage with respect to the positive-sequence voltage exists each for grounded and isolated grounded distribution system. In the present work, residual voltage is taken into account as afeature for the detection of HIF. The detail machine steps of the proposed technique area unit provided below. The three-phase voltages are collected at the relay bus at 1 khz sampling rate for a 50 Hz power system. The residual voltage e_{rk} computed at k_{th} instant is given as

$$e_{rk} = v_{ak} + v_{bk} + v_{ck} \qquad (1)$$

Where, v_{ak}, v_{bk}, and v_{ck} are the voltages of phase-a, phase-b and phase-c respectively at e_{rk} instant of. The one-cycle superimposed parts of the residual voltage is computed as below that has ability to live the randomness, no periodicity and therefore the presence of non-harmonic parts during a signal and is appropriate within the characterization of HIFs. The one cycle distinction of residual voltage is given as,

$$e_{rk\_diff} = e_{rk} - e_{rk-N} \qquad (2)$$

where, N is that the variety of samples per cycle. more the absolute total of e_{rk_diff} over one-cycle is computed to get a better index for discriminating HIFs from different non-fault events having similar characteristics as that of HIFs andis given in (3) as,

$$g_k = \sum_{k-N}^{k} (e_{rk\_diff}) \qquad (3)$$

The algorithm will detect a fault if,

$$g_{k+t_{wait}} > g_{th} \qquad (4)$$

The fault detector index g_k is zero throughout traditional operative condition (including each balanced and unbalanced loading). At the origin of a fault (for each tangency fault yet as HIF) or the other non-fault events (e.g. Load switch, capacitor switch etc.), the worth the worth will increase from zero to higher price altogether cases and once more returns to zero among two cycle (40 ms) altogether cases except HIF. Just in case of HIF, the value of g_k remains high until it persists. This is often happened thanks to the presence of distortions and irregularities within the residual voltage during HIF. Within the gift study twait is fastened at zero.1 s. Though, the criterion, $g_{k+twait} > 0$ is able to discriminate HIF from the other non-fault transients, tiny low tiny low greater than zero is taken into account for making certain security in HIF detection. For higher understanding the projected theme is provided within the flow chart as shown in Fig

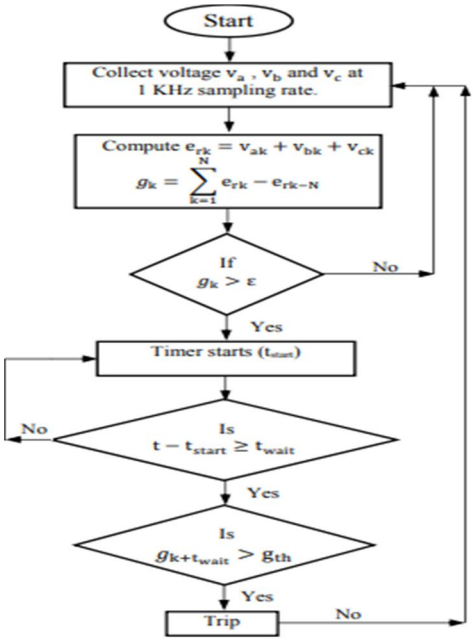


Fig. Flow chart of the proposed scheme.

IV. CONCLUSION

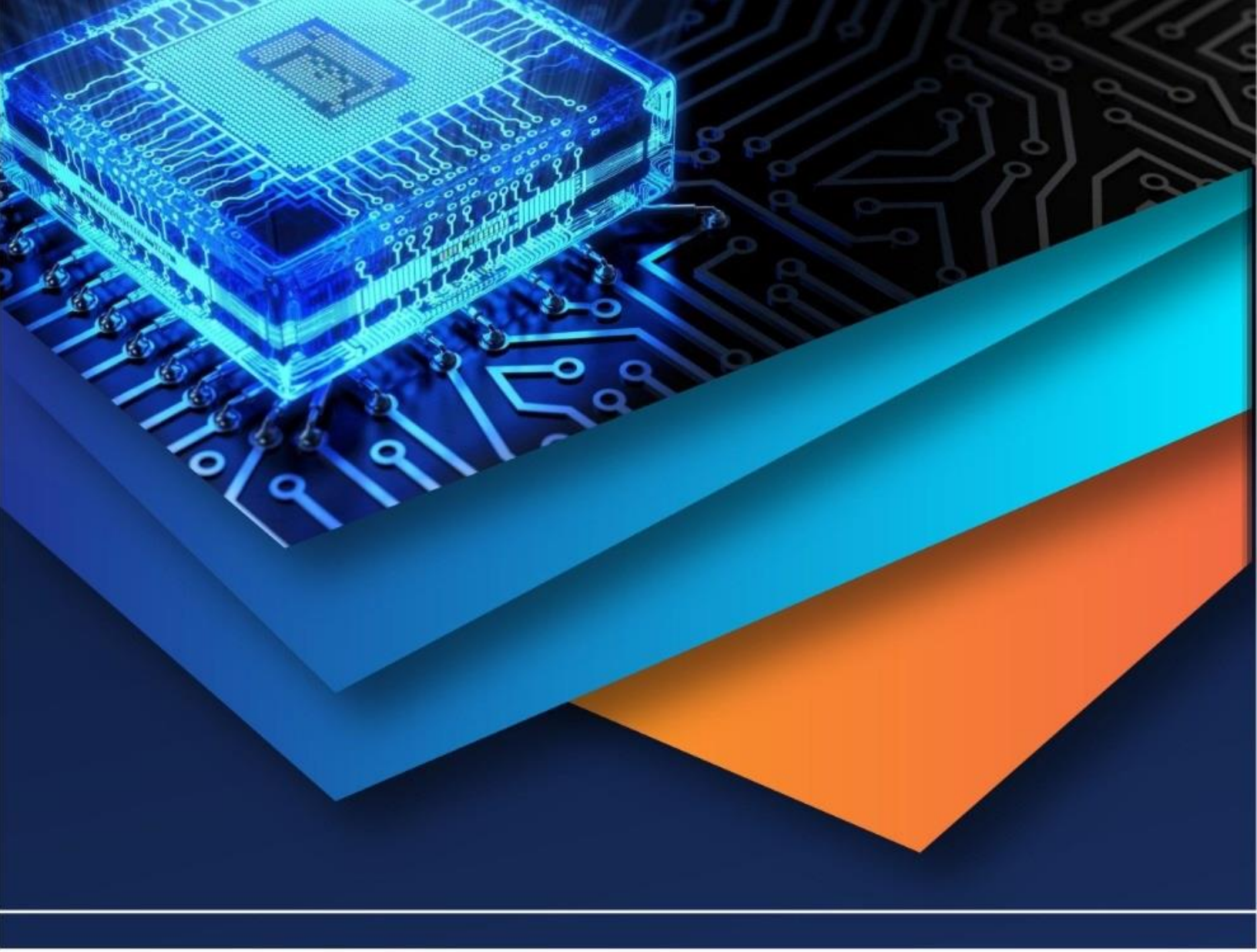
A superimposed part of residual voltage primarily based technique is planned during this paper for police investigation hifs in distribution systems put in with distributed generators. The method is tested for hifs initiated at totally different locations of the feeder. Performance of the theme is additionally tested for various non-fault events like unbalanced loading, single-phase load switching and electrical condenser change which may generally conjointly produce similar characteristics as that of hifs. The results show that using planned theme hifs may be detected with high accuracy in 0.1 s once the beginning of the fault. The computational burden of the planned theme is additionally terribly less.

V. RESULT

The projected methodology is tested by making HIFs at totally different locations of the take a look at feeder of EMTDC/PSCAD simulation computer code is employed for information generation. The data sampling rate is maintained at one kilocycle. Performance of the proposed methodology is additionally tested for various non-fault events such as balanced and unbalanced load shift and capacitors switching that additionally manufacture similar characteristics as that of HIF. The different strategies offered within the literature either use current or each current and voltage waveforms as input options for HIF detection. throughout HIF because the increase of current with respectto the pre-fault current is extremely less (in this study it's kept < 5%), the distortions and irregularities within the current waveform at the relay location is insignificant that is clearly evident. However, the voltage waveforms ar less captivated with pre-fault loading conditions. HIFs ar largely single-line-to-ground sort. Occurrences of such faults introduce unbalance into the system and may manufacture important percentage of residual current with relevancy the positive sequence current just in case of a grounded distribution system. However, important share of residual voltage with respect to the positive-sequence voltage exists each for grounded and isolated grounded distribution system. In the present work, residual voltage is taken into account as a feature for the detection of HIF.

REFERENCES

[1] Kumar Nayak , Member, IEEE, Kumari Sarwagya, and Tapaswini Biswal , “A Novel High Impedance FaultDetection Technique in Distribution Systems With Distributed Generators Paresh” , IEEE 2016
[2] Medugu, D. W. & Michael, “Integrated Solar – grid Hybrid Power Generating System for Residential Application” Global Journal of Researches in Engineering: F Electrical and Electronics EngineeringVolume 14 Issue 4 Version 1.0 Year 2014
[3] V. Torres, H. F. Ruiz, S. Maximov and S. Ramírez, “Modeling of high impedance faults in electric distribution systems”, IEEE, 2014
[4] S. H. Mortazavi, Z. Moravej and S. M. Shahrtash, “A hybrid method for arcing faults detection in large Distribution networks”, International Journal of Electrical Power & Energy Systems, Elsevier, vol. 94, no.16, (2018) January, pp. 141-150.
[5] Z. Liang “High impedance fault detection in power distribution systems with impedance Based methods in frequency domain”, Ph.D. Thesis, Sun Yat-sen University, (2016) October.
[6] A. Emanuel, “High impedance fault arcing on sandy soil in 15KV distribution feeders: contributions to the evaluation of the low frequency spectrum”, IEEE Transactions on Power Delivery, vol. 5, no. 2, (1990) April, pp. 676-686.
[7] M. Banejad, “High impedance fault detection: Discrete wavelet transform and fuzzy function approximation”,Journal of AI and Data Mining, vol. 2, no. 2, (2014) June, pp. 149-158.
[8] M. F. Akorede, “Wavelet Transform Based Algorithm for High- Impedance Faults Detection in Distribution Feeders”, European Journal of Scientific Research, vol. 20, no. 2, (2010) September, pp. 237- 247.
[9] T. M. Lai, “High-impedance fault detection using discrete wavelet transform and frequency range and RMS conversion”, IEEE Transactions on Power Delivery, vol. 20, no. 1, (2005) April, pp. 397-407.
[10] A. R. Sedighi, “High impedance fault detection based on wavelet transform and statistical pattern recognition”, IEEE Transactions on Power Delivery, vol. 20, no. 4, (2005) September, pp. 2414-2421.
[11] S. S. Gururajapathy, “Fault location and detection techniques in power distribution systems with distributed generation: A review”, Renewable and Sustainable Energy Reviews, vol. 74, pp. 949-958, (2017) April.
[12] A. M. Sharat, “A neural network based back error propagation relay algorithm for distribution system high impedance fault detection”, 2nd International Conference on Operation and Management in Advances in Power System Control, vol. 2, no. 1, (1993) June, pp. 613-620.
[13] A. S. Bretas, “A novel high impedance fault location for distribution systems considering distributed generation”, In Transmission & Distribution Conference and Exposition: Latin America, (2006) August,.pp. 1-6



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY