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**Title Local Decision Module**

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Abstract. *Please write down the abstract of your paper here Please write down the abstract of your paper here Please write down the abstract of your paper here nd protection relays in ADN. The proposed scheme proved its effectiveness in ADN. Please write down the abstract of your paper here.*

Keywords: Power System Protection, Adaptive protection, directional over current relays, local decision module, active distribution network.

1. Introduction. In recent years, the great development in renewable energy resources and increasing of electric power demand poses new challenges on the distribution networks [1]. The present passive distribution networks (PDN) are of dual structure as they consist of substations and loads [2]. Nowadays, there is a need to convert the current PDN into an Active Distribution Network (ADN) of a ternary structure; distributed generations (DGs), substations and loads [3].

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In recent years, the great development in renewable energy resources and increasing of electric power demand poses new challenges on the distribution networks [1].

**2. The Proposed Scheme.** Based on the adaptive protection and logical information exchange strategy of the wide area network technology, the proposed protection scheme ensures high level of reliability to locate and isolate the fault. The framework of proposed scheme is shown in figure1. The proposed protection scheme is aimed at protecting the electrical equipment from the fault current by isolating the faulty section only.

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Figure. 1. Framework scheme

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**2.1 The operation modes of the proposed scheme**. In the proposed scheme, there are two operation modes based on the state of communication between LPC and WAP center. If the communication link is in a good state, the protection system will operate in an adaptive mode, otherwise, the protection system will operate at local decision mode. In an adaptive protection mode, all relays in the local areas operate as standard inverse characteristic [14]. The relays setting updates to the optimal setting according to the topology change to prevent any miscoordination between primary and backup relays.

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**2.2 Optimal over current relay setting calculations.** When the protection system operates in adaptive mode, the optimal over current relay setting must be calculated. It is usually formulated as a constrained optimization problem. Several alternative objective functions have been proposed in literature [15-16]. The most common objective function used in literature is the minimization of the sum of the operating times of all the Directional Over Current Relays for the maximum fault current, this objective function is expressed as follows:

Where *m* is the number of relays in the local area, top,i  is the operation time for relay Ri .

It is usually formulated as a constrained optimization problem. Several alternative objective functions have been proposed in literature. µ and β are the relay characteristic constants as shown in table 1.

Table 1. Overcurrent Constant

|  |  |  |
| --- | --- | --- |
| Relay type | µ | β |
| standard relays | 0.14 | 0.02 |
| inverse relays | 13.5 | 1 |
| extremely relays | 80 | 2 |

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**2.3 Local Decision Module.** In the proposed scheme an LDM is added in the LPC, this module gets permission to work only when the communication link between LPC and WAP center is failed. In the proposed scheme an LDM is added in the LPC, this module gets permission to work only when the communication link between LPC and WAP center is failed. In the proposed scheme an LDM is added in the LPC, this module gets permission to work only when the communication link between LPC and WAP center is failed.

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Table 2. Output Signals for

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Relay | Ai | Di | ADi | Trip | Delay | Block |
| R1 | 1 | 1 | 1 | YES | 0.4 Sec | NO |
| R2 | 1 | 1 | 1 | YES | 0.2 Sec | NO |
| R3 | 0 | 0 | 0 | NO | - | YES |
| R4 | 1 | 0 | 0 | NO | - | YES |
| R5 | 1 | 0 | 0 | NO | - | YES |

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**3. Result and Discussion.** To investigate the effectiveness of the proposed protection scheme, a simple real distribution system is chosen. To investigate the effectiveness of the proposed protection scheme, a simple real distribution system is chosen. To investigate the effectiveness of the proposed protection scheme, a simple real distribution system is chosen.

**3.1 Scenario 1.** In the first scenario, the following assumptions are made:

1. DG2 is assumed to be isolated from the network.
2. Communication link with WAP center is at good state.

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**3.2 Scenario 2.** In the second scenario, the effect of DGs on the proposed protection scheme is investigated. The following assumptions are made:

1. The DG2 is assumed to be integrated with network.
2. Communication link with WAP center is lost during the integration.

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**4. Conclusion.** In this paper a new WAP scheme based on a combination between an adaptive protection and LDM is proposed. In this paper a new WAP scheme based on a combination between an adaptive protection and LDM is proposed.

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**REFERENCES**

1. B. S. Munir, A. Trisetyarso, M. Reza and B. S. Abbas, Application of Artificial Neural Networks for Power System Oscillation Prediction, *ICIC Express Letters,* vol. 13, no. 9, pp. 815-822, 2019.
2. L. M. W. G. Fan Zhang, An Integrated Wide Area Protection Scheme for Active Distribution Network Based On Fault Component Principle, *IEEE Transaction on Smart Grid*, vol. 10, no. 1, pp. 392-402, 2019.
3. V. F. Martins and C. L. T. Borges, Active distribution network integrated planning incorporating distributed generation and load response uncertainties, *IEEE Transactions on Power Systems*, vol. 26, no. 4, pp. 2164-2172, 2011.
4. X. Chen, Y. Li, M. Zhao, A. Wen and N. Liu, A coordinated strategy of protection and control based
5. C. Chandraratne, W. L. Woo, T. Logenthiran and R. T. Naayagi, Adaptive Overcurrent Protection for Power Systems with Distributed Generators, *2018 8th International Conference on Power and Energy Systems* (ICPES), 2018.
6. J. Ma, X. Xiang, R. Zhang, J. L. a. P. Li and J. S. Thorp, Regional protection scheme for distribution network based on logical information, *IET Generation, Transmission & Distribution*, vol. 11, no. 17, pp. 4314-4323, 2017.
7. J. Bertsch, C. Carnal, D. Karlson, J. McDaniel and K. Vu, Wide-Area Protection and Power System Utilization, *Proceedings of the IEEE*, vol. 93, no. 5, pp. 997-1003, 2005.
8. M. N. Alam, S. Chakrabarti, A. Sharma and S. C. Srivastava, An Adaptive Protection Scheme for AC Microgrids Using μPMU Based Topology Processor, *2019 IEEE International Conference on Environment and Electrical Engineering and 2019 IEEE Industrial and Commercial Power Systems Europe* (EEEIC / I&CPS Europe), 2019.
9. Shalini, S. R. Samantaray and A. Sharma, Enhancing Performance of Wide-Area Back-Up Protection Scheme Using PMU Assisted Dynamic State Estimator, *IEEE Transactions on Smart Grid*, vol. 10, no. 5, pp. 5066-5074, 2019.
10. E. J. Holmes, *Protection of Electricity Distribution Networks*, 3rd Edition, 2011.