International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8, Issue-1, May 2019

Implementation of Wi MAX Protection in Six Phase Transmission Line

L. Kishore, K. Raghu Ram, B.V. Sanker Ram

Abstract: ***Nowadays, six phase transmission line plays extensive role in electrical power system. The bulk amount power can be transfer and increase the capability of overhead transmission line using six phase transmission line. It has consists of mutually coupled two three phase transmission lines, which are the better alternative approach for enhancing the power transfer capability. Since the six phase transmission line carries the huge power, some protection difficulties are existed in the operation of system. In this paper, Wimax protection has implemented in six phase transmission system for improving the protection security in 6 phase transmission lines. The WImax system has designed and simulated using MATLAB/SIMULINK environment.***

Index Terms: WiMAX, six phase transmission line, primary and secondary protection.

I. INTRODUCTION

Nowadays, the electrical power system becomes more complex due to large size of generating size and incorporation of renewable energy sources. The population is also increasing rapidly day by day thought the world. As rapid growth of population, the utilization of electrical energy also used extensively. Thereupon, huge amount of power is needed to transfer everywhere but the 3-phase transmission is not enough to transmit the large amount power from one place to another place. So the feasible and best idea is to mutually coupling the two three phase transmission lines then it becomes incredible power transfer capability of six phase transmission line[1][2][3]. When the enhance of the transmission line strength then voluntarily transmit the very large power to long distance with low losses. However, the number of protection and security problems are appear in system while transferring the power through the six phase transmission line. In addition, many researchers[1], [4]–[7] focused on accurate protection systems for minimizing the problems in six phase transmission line. As consider possibilities of faults in six phase transmission line is 120 and 11 for three phase transmission line. And, various kinds of protection schemes are penetrated in six phase system namely electromagnetic, static and digital relays.

Revised Manuscript Received on 22 May 2019.
***** Correspondence Author
L. Kishore*, Electrical and Electronics Engineering, Sreekavitha engineering college, JNTUH, Khammam, Telagana, India.
K. Raghu Ram, Electrical and Electronics Engineering, Laqshya Institute of Technology& Sciences, JNTUH, khammam, Telangana, India.
B.V. Sanker Ram, Electrical and Electronics Engineering,JNTU college of engineering, JNTU, Kuatpally, Hyderabad, Telangana, India.

The protection schemes would prefer in realistic power system for as early as possible to respond. In this paper, proposed the novel based WiMAX technique has implemented for the problem of protection scheme of six phase system. The proposed system includes primary and back up protection.

II. SIX PHASE SYSTEM

A. *Six Phase Electrical Energy Production:*

The generation voltages of six phases and three phases are similar phase sequence. When consider the three phase system, the armature coils displacement is 120^0 one to each other in stator of the generator[5], [6], [8]. Also, in six phase system, the armature coils are placed with 60^0 apart from to another one in adjacent side coils of generator is demonstrated in fig.1.

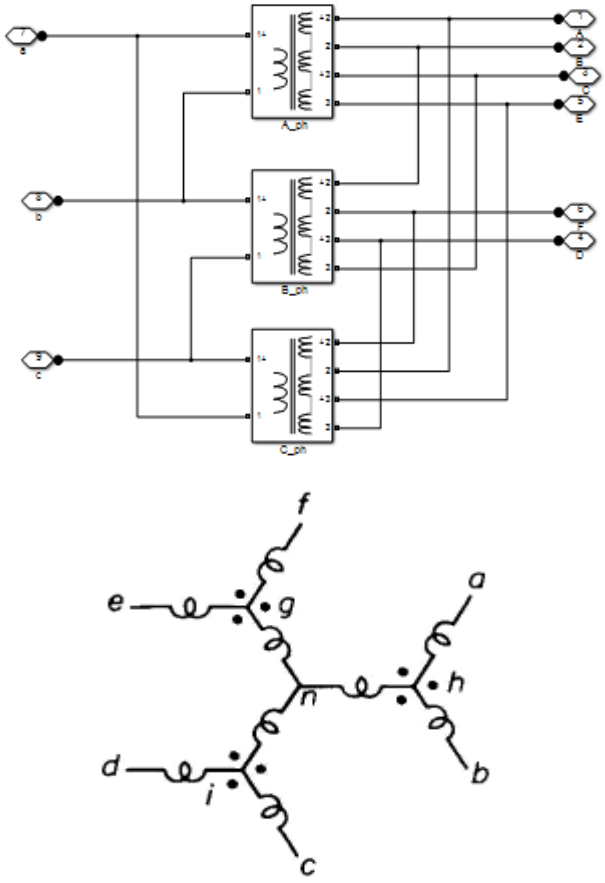

Fig.1(a) six phase voltages and armature coils in six phase system.

The current is passing to the system when the rotor is rotated in clockwise direction then automatically the emf is induced in the coils such as aa^1, bb1, cc1, dd1, ee1 and ff^1 along with the voltages are V_a,V_b,V_c,V_d,V_e and V_f. it has shown the different phase sequence that is a-b-c-d-e-f and waveforms of voltage and vector representation is illustrated in fig.1(b) and (c).

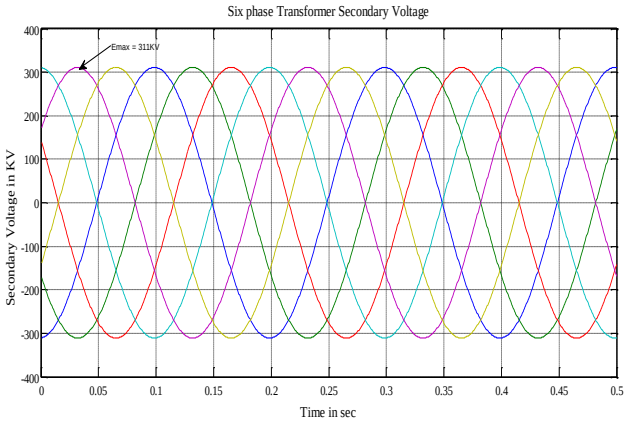

Fig.1 (b) the waveform of voltage in six phase system

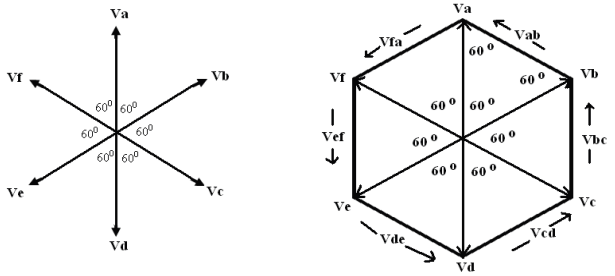

Fig.1(c) voltage sequence and vector representation in six phase system

When assume the AC sinusoidal voltages in six phase system then the instantaneous voltage is demonstrated in six different equation forms with respect to time. The six phase voltages are given as below,

$$V_a = E_m Sinwt \quad (1)$$

$$V_b = E_m Sin(wt - 60^0) \quad (2)$$

$$V_c = E_m Sin(wt - 120^0) \quad (3)$$

$$V_d = E_m Sin(wt - 180^0) \quad (4)$$

$$V_e = E_m Sin(wt - 240^0) \quad (5)$$

$$V_m = E_m Sin(wt - 300^0) \quad (6)$$

B. *Transmute three phase double circuit into six phase system:*

The mutually coupled two three phase system can be transmuted into six phase system with the assistance of two identical pairs of three phase transformers are connected in delta-to-star model.

The input terminals of three phase system A,B and C are connected to delta type primary winding of transformer then the output is obtained from star form of secondary winding of transformer at -30^0phase shift[3], [9], [10]. Moreover, an interchange the connections of A and C in primary side then get the output of remaining three phases are achieved at $+30^0$phase shift[11]. The transformer specifications are represented at $\pm 30^0$ phase shift in fig.2,

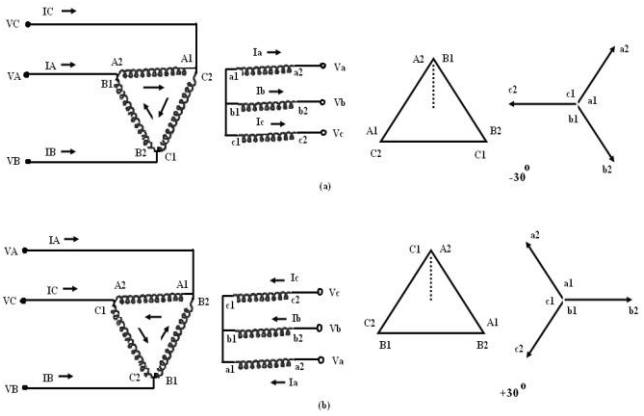

Fig.2 Transformer specifications at $+30^0$ and -30^0 phase shift.

C. *WiMAXTechnology:*

Recently, various kinds of notable technologies such as electronic, communication, computer science and neural network are penetrated into the electrical power system.Sincelots of innovative technologies are incorporated into transmission system, it can easily contribute the protection and security to typical electrical system[12], [13]. In this paper, proposed the Wimaxtechnology for providing the protection and improve the efficiency of six phase system. Nowadays, WiMAXhas been superior position in wireless technology instead of WLAN in terms of offer the protection to six phase system as well as the economical efficiency is also reasonable. Likewise, the standard forum of WiMAX is 802.16a on 2-11GHz frequency and 802.16c on 10-66GHz and it would prefer to cable and DSL[14], [15]. Finally, WiMAX technologies playsa important role in electrical system for enhancing the reliability of the system and minimizing the problem of controlling of six phase system.

III. SIMULATION ANALYSIS:

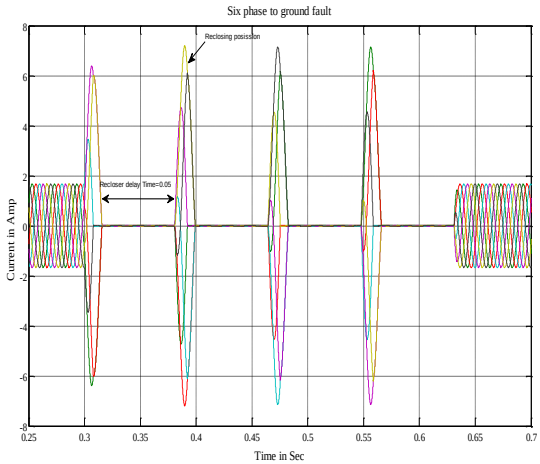

Fig.3 Wimax protected system under six phase fault

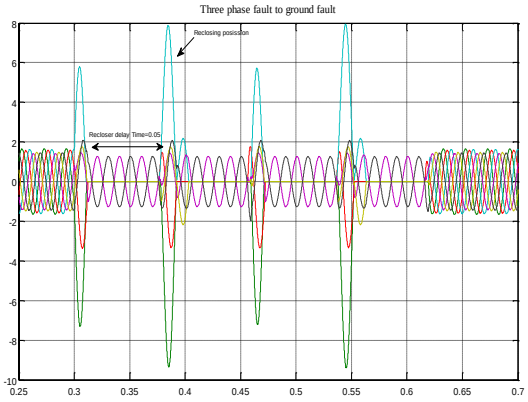

Fig.3 Wimax protected system under Three phase fault

In fig. 2&3 Trs shows the time taken to reclose the network by controlling the circuit breaker (CB). The time taken for reclose is 0.05sec after fault detection. The proposed wimax controller will send the signal to the breaker for check whether the fault is presented or not. If still fault existed then it will opens the CB, the proposed system can perform sequence of attempts to know fault type. After prescribed attempt, fault is existed the proposed system will completely opens the system by treating fault as a permanent fault. The proposed system can also provide primary and backup protection with small amount of time delay.

VI. CONCLUSION:

This paper describes about wide area network protection scheme in six phase transmission lines. Wimax protection scheme plays a key roll in six phase protection, the conventional current differential protection is not suitable to six phase transmission line; due to its multi-phase transmission. In six phase transmission the line impedances are reduced, due to this high sensitive protection system is needed. Whenever the faults occur on the system; fault current increases drastically due to its low impudence. The proposed wimax protection scheme is very sensitive and it can facilitate primary and backup protection. If any mal-operation of primary protection occur, the secondary protection will take care with a fraction of time delay and it can facilitate auto reclosing action also. It can analyze the fault type based on fault period. The performance of the wimax system was analyzed based on Simulink results.

REFERENCES

1. H. C. Barnes and L. O. Barthold, “High phase order power transmission,” Electra, vol. 24, pp. 139–153, 1973.
2. P. S. Subramanyam, “Contributions to the analysis of six phase system.” Ph. D. Thesis, IIT, Madras, 1983.
3. J. R. Stewart and D. D. Wilson, “High phase order transmission--a feasibility analysis part I--steady state considerations,” IEEE Trans. Power Appar. Syst., no. 6, pp. 2300–2307, 1978.
4. J. R. Stewart and D. D. Wilson, “High phase order transmission--a feasibility analysis part II--overvoltages and insulation requirements,” IEEE Trans. Power Appar. Syst., no. 6, pp. 2308–2317, 1978.
5. R. Brown and J. R. Stewart, “Six-phase successfully applied to utility transmission system,” in CIGRE paper, 1998.
6. A. P. Apostolov and R. G. Raffensperger, “Relay protection operation for faults on NYSEG’s six-phase transmission line,” IEEE Trans. Power Deliv., vol. 11, no. 1, pp. 191–196, 1996.
7. N. B. Bhatt, S. S. Venkata, W. C. Guyker, and W. H. Booth, “Six-phase (multi-phase) power transmission systems: fault analysis,” IEEE Trans. Power Appar. Syst., vol. 96, no. 3, pp. 758–767, 1977.
8. S. S. Venkata, W. C. Guyker, W. H. Booth, J. Kondragunta, N. K. Saini, and E. K. Stanek, “138-kV, six-phase transmission system: fault analysis,” IEEE Trans. Power Appar. Syst., no. 5, pp. 1203–1218, 1982.
9. A. Apostolov and W. George, “Protecting NYSEG’s six-phase transmission line,” IEEE Comput. Appl. power, vol. 5, no. 4, pp. 33–36, 1992.
10. Y. H. Song, A. T. Johns, and R. K. Aggarwal, “Digital simulation of fault transients on six-phase transmission systems,” in 1993 2nd International Conference on Advances in Power System Control, Operation and Management, APSCOM-93., 1993, pp. 385–388.
11. G. C. Sekhar, P. S. Subramanyam, and B. V. S. Ram, “Logic based detection of Negative sequence currents for six phase system,” Int. J. Appl. Eng. Res., vol. 6, no. 6, pp. 1311–1322, 2011.
12. Z. Liyu, “The application of the Wimax technology in the electric power distribution automation,” in 2008 China International Conference on Electricity Distribution, 2008, pp. 1–3.
13. G. T. Heydt, C.-C. Liu, A. G. Phadke, and V. Vittal, “Solution for the crisis in electric power supply,” IEEE Comput. Appl. Power, vol. 14, no. 3, pp. 22–30, 2001.
14. W. Roh and V. Yanover, “Introduction to WiMAX Technology,” WiMAX Evol., p. 1, 2009.
15. J. Bertsch, C. Carnal, D. Karlson, J. McDaniel, and K. Vu, “Wide-area protection and power system utilization,” Proc. IEEE, vol. 93, no. 5, pp. 997–1003, 2005.

AUTHORS PROFILE

L.Kishore he obtained his B.Tech in Electrical and Electronics Engineering from JNTU, Hyderabad in 2006. He obtained M.Tech in Electrical Power Systems in 2009 from JNTU college engineering Hyderabad and pursuing Ph.D at JNTU, Hyderabad. He has teaching experience of 12 years and guided more than 25 UG projects and 11 PG projects. He has four International Journal publications to his credit. At present he is working in Sreekavitha Engineering college, Khammam, Telagana-5007002,India as Associate Professor in department of Electrical and Electronics Engineering and his areas of interest include 6-Phase system , Power Systems stability&power Systems Protection

Dr.K.Raghu Ram obtained his B.Tech in Electrical and Electronics Engineeringin the year 1979, M.Tech in Power Systems in 1983, Ph.D in 2004 from JNTU,Hyderabad, Andhra Pradesh, India. He has 12 technical papers to his credit invarious international and national journals and conferences. He is guiding 6research scholars for Ph.D and guided more than 70 M.Tech Projects. His areasof interest include Multi Phase Transmission System, FACTS, Power Systems stability and MultiPhase Machines. He received “Best Teacher” award twice from Sathyabhama DeemedUniversity, Chennai, India. Also he got sanctioned Rs: 3, 00,000/- AICTE, New Delhi researchProject on“3phase/6 phase transmission line simulator” while working in sathyabama DeemedUniversity Chennai, India during 2003. Presently he is the Principal of Laqshya Institute ofTechnology& Sciences, Tanikella (V), Konijerla (M),khammam (Dt) – 507 305, Telangana,India.

Dr.B.V.Sanker Ram obtained his B.E in Electrical Engineering in the year 1982from OU college of Engineering and Obtained M.Tech in Power Systems in1984 from OU College of Engineering and Ph.D in 2003 from JNTU. He joinedin JNTU in 1985 and worked in various Capacities. He was the head of theDepartment from 2006-2008. As Head of the department he has establishedPower Electronic controlled drives lab, which is unique in the state of A.P. He has 72 technicalpapers to his credit in various international and national journals and conferences. He has guided 17 research scholars for Ph.D and 6 candidates are still pursuing their research. He guided morethan 100 M.Tech Projects. His areas of interest include FACTS, Power Electronic Applicationsto Power Systems, Power Systems Reliability. Presently he is the Chairman of Board of Studiesin Electrical & Electronics Engineering JNTU, Kuatpally, Hyderabad-500085, Telangana, India.