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Relay coordination in parallel network using software techniques

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Abstract — in this paper, I presented different techniques for relay coordination using software techniques like etap software, link net structure etc. Now days, the demand of electricity is increasing. So, the network of electricity from generation to distribution is very large system required to build in situation. The networks of state electricity boards typically have 10 to 25 or more buses, 30 to 50 transmission lines and 70 to 100 over current coordination relays. The exercise of load flow analysis, fault level calculations and listing the primary backup pairs will be very tedious to set with this back up protection with cascade network. Also several problems would be required to calculate TMS of relays so that minimum discrimination margin as required is found between relay and its backup relays. This is only by using some computer programming. In this paper, shows the some algorithm techniques and also discuss the advantages of latest software ETAP.

Keywords: Optimal coordination of over current relay, Coordination time interval, Time multiplier setting, Current setting, ETAP software, algorithm, coordinate technique

I. INTRODUCTION

In last few years, so many techniques are developed in field of relay coordination in a power system. The importance of coordination of different protective device is increasing now days. A power system consists of many number of equipment like as a numbers of transformers, motors, generators etc so more number of circuit breakers and relays are required to protect the system using ratings of it. A relay must get sufficient chance to protect the zone under its primary protection. Only if the primary protection does not clear the fault, the back-up protection should initiate tripping as per time of the required. The relay coordination in distribution network is highly constrained optimization problem to coordinate in parallel network.

The demand for electrical power generally increases at a faster rate in economically emerging countries so it is necessary to install of transmission lines reaching out all the areas of country. It requires EHVAC and HVDC transmission lines to be erected. The voltage of transmission nowadays has reached 765 KV ac and still higher voltages of transmission are planned. These transmission lines are required to be protected by comprehensive and quite involved protective schemes so that the power interruptions are reduced to minimum with regard the times of interruption and the area are affected. The protective scheme must operate fast and selectively before the power system become unstable. It is the usual practice to protect feeders of 11 KV and transmission lines of 66 KV by over current and earth fault relays as primary (main) protection and Transmission lines of 132 KV and 220 KV are protected by distance relay as primary protection, and earth fault relay as secondary or back up protection. It is very needed as a protect of costly equipments. So, we know, how much important of the correct relay coordination to avoid mal functioning operation. In this paper, I have presented the different techniques for relay coordination of research papers and Also I include features of the latest software of ETAP and how easier to implement the relay coordination in this software.

II. SIMULATION OF POWER SYSTEM IN LATEST SOFTWARE - ETAP & FEATURES OF ETAP

For the last few years electrical engineers have been focusing on the power system studies using ETAP software tool. Recent advances techniques in engineering sciences have brought a revolution in the field of electrical engineering after the development of powerful computer based software. This research work highlights the effective use of Electrical Transient analyzer Program (ETAP) software for analyses and monitoring of large electrical power system

for many years electrical engineers have relied on the power of mainframe computers to analyzed and design power systems to easy to use. A structured computer program that uses technically correct models, employs a user-friendly interface, uses a common data base, and traps user errors is a powerful tool which greatly enhances the engineer's efficiency and easy productivity. ETAP is an engineering design and analysis program which satisfies these criteria and ETAP performs numerical calculations with tremendous speed, automatically applies industry accepted standards, and provides easy to follow output reports.

ETAP includes the following programs,

- One Line Diagram
- Load Flow
- Short Circuit
- Dynamic Stability
- Cable Pulling
- Ground Grid Design
- Induction Machine Parameter Estimation
- Motor Acceleration
- Motor Starting
- Cable Derating
- Induction Machine Torque/Slip Curve
- Load Schedule

Features of ETAP,

- ETAP is a map interface applied software tools, it can be used for designing power plant, substations, there are generators, power or distribution Transformers, cable lines and motors model libraries in it, the IEC standard (international electro technical commission standards) is used to make off-line simulation, besides, ETAP software can also operate on line to achieve high-level Monitoring, on-line simulation, optimization, energy Management system and high-speed intelligent throwing loads and so on.

- System studies are an integral part of power System engineering and design and A structured Computer program that uses technically correct Models, employs a user-friendly interface, uses a common data base, and traps user errors is a powerful tool which greatly enhances the engineer's efficiency and great productivity tools. ETAP is an engineering design and analysis program which satisfies these criteria.

- ETAP capable of handling 1000 buses contains a load schedule program which tracks up to 10,000,000 load items, and reports the voltage and short-circuits current at the terminals of each load item whichever to analyze them. This capability makes ETAP suitable for large industrial facilities.

- A complete system analysis including of load flow, short circuit, and voltage transient stability studies. Because of the unique data sharing capability of ETAP's programs, the data for an entire system needs to be entered only once with three user-friendly editors (Bus, Branch, and some parameters). By not having to continually enter data, the user is free to concentrate his attention on analytical tasks, rather than bookkeeping.

  Errors in data input are thus reduced and more meaningful study results are obtained like a ETAP has many advance features than the others method. ETAP performs numerical calculations with tremendous speed, automatically applies industry accepted standards. Engineers depend on continual development of software to keep in step with fast-paced technological advancement. Today's electrical engineer is limited only by the software available to him so it fastest on ETAP is a technically accurate, user-friendly software package designed with the working engineer in mind. From the common data base input editors, to the clearly structured output reports, ETAP has pushed forward the frontier of desktop power system analysis software.

III. OPTIMAL COORDINATION OF OVERCURRENT RELAY

3.1 Existing Optimal Methods in A Power System

Fig.1 shows a section of a power system with several protection zones. Each protection zone consists of a primary and a back up over current relays. It is desirable that all over current relays operate as fast as possible in order to reduce the shock to the power system. This can be achieved by using optimal co-ordination of the over current relays in the system.

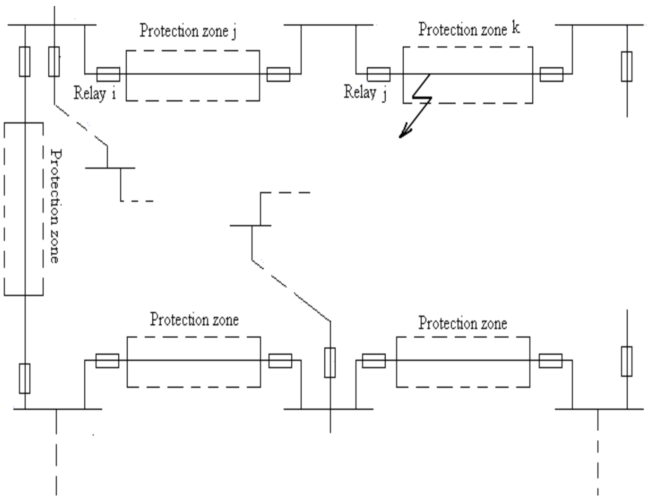

Fig. 1: Sample Power System

The optimal co-ordination of relays is described as an optimization problem where the sum of the weighted relay operation times is minimized as follows,

$$Min\ (obj = \sum_i \sum_j \sum_k W_{ijk} * T_{ijk}) \qquad (1)$$

Subject to,

$$TDS_{\min} \le TDS_i \le TDS_{\max} \qquad (2)$$

$$I_{pi_{\min}} \le I_{pi} \le I_{pi_{\max}} \qquad (3)$$

$$T_{i_{\min}} \le T_i \le T_{i_{\max}} \qquad (4)$$

$$T_i(br) - T_j(pr) \ge CTI \qquad (5)$$

Where,

T_{ijk} : The operation time of relay i in zone j for a fault in zone k

W_{ijk} : The weighted coefficient associated with T_{ijk}

TDS_i : The time dials setting of relay i

I_{pi} : The current value of relay i

$I_{pi_{\min}}$: The minimum of pick up current value of relay i

$I_{pi_{\max}}$: The maximum of pick up current value of relay i

T_i : The operation time of relay i, $T_i = f_i(TDS_i, I_{pi}, I_i)$

$T_{i_{\min}}$: The minimum of operation time of relay i

$T_{i_{\max}}$: The maximum of operation time of relay i

$T_i(br)$: The operation time of back up relay i

$T_j(pr)$: The operation time of primary relay j

The weighted coefficients, W_{ijk} in equation (1) are positive real numbers whose values depend on the probability of the short circuit fault occurrence in each zone, the value of which is commonly determined experimentally.

Several models have been proposed for expressing the time-current characteristics curves of over current relays,

For example,

$$T_i = K * TDS_i \tag{6}$$

Where,

$$K = \frac{0.14}{\left(\frac{I_i}{I_{pi}}\right)^{0.02} - 1} \tag{7}$$

And I_{pi} and I_i are known from the system requirements.

Using equation (6), the operating time of an over current relay can be described as a linear function of TDS. So that the objective function is defined as a linear function whose solution can be obtained by using a linear optimal programming algorithm.

IV. TEST RESULT ANALYSIS

In this paper the 8-BUS network is considered. By using primary/back up relays pairs are determined. Fig.2 shows the network under consideration.

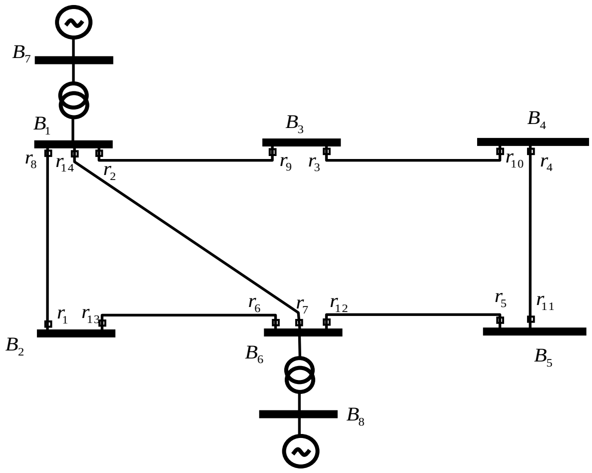

Fig.2: 8 bus Network

Tables (1) to (4) reveal network information which is obtained from reference [5].

Table 1: Line Information

Line	R/kmΩ	X/kmΩ	Length (km)
1-2	0.0042	0.0555	110
1-3	0.0059	0.0634	80
3-4	0.0048	0.0554	90
4-5	0.0056	0.0398	110
5-6	0.0055	0.0449	120
6-2	0.0049	0.0545	80
6-1	0.0055	0.0480	110

Table 2: Generator

Node	Sn (MVA)	Vn (kV)	Xbus(%)
7	150	11	16
8	150	11	16

Table 3:Transformer Information

Line	Sn(MVA)	Vp (kV)	Vs (kV)	X(%)
7-1	150	11	150	5
8-6	150	11	150	5

Table 4: Load Information

Node	2	3	4	5
P(MW)	40	50	80	80
Q(MVAR)	30	50	50	60

In this paper load flow and fault current programs are written using MATLAB software and based on the information in Tables (2) to (4). Table (5) shows primary/back up relays pairs

Table 5: Primary/ Back up Relay Pairs

Item	Primary	Back up	Item	Primary	Back up
1	1	6	11	14	9
2	7	13	12	8	9
3	12	13	13	5	4
4	2	7	14	2	10
5	8	7	15	4	3
6	6	14	16	3	3
7	12	14	17	10	11
8	13	8	18	2	1
9	6	5	19	14	1
10	7	5	20	11	12

Relay current setting depends on the pickup current value & it is minimum current which is used for the operation of over current relay. The pickup current has value which falls between upper and lower limits. The lower limit is equal to the maximum load current multiplied to 1.3 of coefficient. The upper limit is equal to a minimum fault current at the far end bus, multiplied by less than 1. So far, in the calculation of load and fault currents, it is required to evaluate load flow, fault current programs based on the information of lines, generators and transformers.

V. CONCLUSION

This paper present of the practical work of software of ETAP for a design or easy to operating quality for a parallel bus network in bus systems. The results of the power network method for 8-bus system are compared with obtained practical Methods results. It has been shown that the results of the power network method are more accurate and the technique is higher speeds of relays operating related to protection gear relays can be achieved.

REFERENCES

(1) Prashant P.Bedekar, Sudhir R. Bhide, and Vijay S. Kale, "Coordination of Over current Relays in Distribution System using Linear Programming Technique" IEE International conference on "Control, Automation, Communicated & Energy Conservation" June 2009.

(2) H.B. Elrefaie, M.R. Irving, S. Zitouni, "A parallel processing algorithm for co-ordination of directional over current relays in interconnected power systems" IEEE Trans. Disrobed. Vol. 141, no. 5. Sept 1994.

(3) A. S. Braga and J. T. Saraiva, "Co-ordination of Directional Over current Relays in Meshed Networks Using Simplex Method",IEEE Conf.MELECON 96, Vol. 3, No. 3, 1996, pp.1458-1463.

(4) S. Jamali, M. Pourtandorost "New approach to coordination of distance relay zone - 2 with over current protection using linear programming methods" IEEE Trans. Describe on Power delivery.

(5) A. Van Der Meer, M. Popov, " Directional relay co-ordination in ungrounded MV radial distribution networks using a RTDS" International Conference on Power Systems Transient in Kyoto, Japan, June 2009.

(6) Keith Brown, Herminio Abcede, Farrokh Shokooh, "Interactive simulation of power system & ETAP application and Techniques" IEEE operation Technology, Irvine, California.

(7) Rana Jabbarkhan, Muhammad Junaid, Muhammad Asgher, "Analyses and Monitoring of 132KV Grid using ETAP Software" Rachna College of Engineering and Technology, Gujranwala, Pakistan.
(8) Rashesh P. Mehta, "Optimal Relay Coordination".
(9) A. Urdenata, H. Restrepo, S. Marques and J. Sanches, "Co-ordination of Directional Overcurrent Relay Timing Using Linear Programming", IEEE Trans on Power Delivery, Vol. 11, No. 1, January 1996, pp.122-129.
(10) J.P. Whiting and D. Lidgate, "Computer Prediction of IDMT Relay Settings and Performance for Interconnected Power Systems", IEE Proceed; C; Gen, Trans.& Distrib., 1983, 130,(3), pp. 139-147.
(11) H. Askarian Abyaneh and R. Keyhani, "Optimal Co-ordination of Over current Relays in Power System by Dual Simplex Method", AUPEC'95, The University of Western Australia, Perth, Australia, 1995.

BIOGRAPHIES

Sameer Patel Doing M.Tech In Electrical Engineering (Power System) At Rajasthan Institute Of Engineering And Technology, Jaipur And Also Completed Diploma & B.Tech In Electrical Engineering.

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