Optimal Relay Coordination for IEEE 9 Bus system by Using Optimal Technique.

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Abstract—For the optimised co-ordination of Over current (OC) relays using this Optimal techniques such as easiest in which i have 2 phase easiest and dual easiest are used. Second way of optimal coordination program is using AI logic system such as genetic algorithm (GA). In this paper, a new approach will be used for optimal coordination of OC relays based on genetic algorithm for consider the IEEE 9 bus system in which 3 generators,3 transformer and 9 bus we can use. In this work, we take into account time setting multiplier (TSM) and plug setting multiplier (PSM) of OC relays in optimization procedure. In this paper present the IEEE 9 bus system simulate by using E-TAP/MATLAB coding with genetic optimized techniques the answers are taken into account as a part optimization procedure, so the outputs are optimized TSM's compare to the conventional method. In other words, the novelty of the paper is taking into account to TSM to handle miscoordination problems. The results obtained are quite encouraging and optimized value will be useful as an effective tool for coordination OC relays.

Keywords - Relay protection; relay co-ordination; optimization; genetic algorithm; E-TAP/MATLAB Coding.

I. INTRODUCTION

During the interconnected large power system to absorbed some abnormal condition like as a over load, over current, undervoltage, undercurrent, under frequency etc. Can be occurred due to the causes of the interruption of the supply and then the equipment can be get damaged will be connected to the system. This can be only achieved by using the reability of the system and also the backup protection can be used. backup protection act as when the fault occur in any second another line defense in case of any failure to take the appreciate action due to it should be operate after certain time, delay will be provided this delay of time kept as a coordination time interval(CTI).it will give the change primary protection to operate.

Now some approaches the optimal relay coordination of the overcurrent relay is proposed in paper[7].in this approaches the optimal relay coordination for overcurrent operation by using some special characteristics and also optimal current setting and time setting of relay can be determine this technique can be solve by using G.A application and it can be improved by using new expression of the objective function it will be also specified in some literature .in other cases the miscoordination operation of the relay can be also solve and more detail about O.F in[9].

In the G.A optimization technique some different changes of the relay setting achieved by create constrain as a objective function. this has defined two problems first is miss coordination and other is time setting and plug setting then the new problem can be achieved by calculating the optimal relay setting of overcurrent relay in power system

II. OVER CURRENT CONSTRAIN

As show in below expressed that coordinate of two over current relay, main relay (m) and back up relay (b), as shown in figure 1, the difference between the operation time of back up relay and the operation time of main relay for faults F1 location and F2 location should be more than Coordination time interval. F1 and F2 are fault at near bus and far away from the bus of main relay respectively. Coordination is the time interval for coordination of main and backup relay.

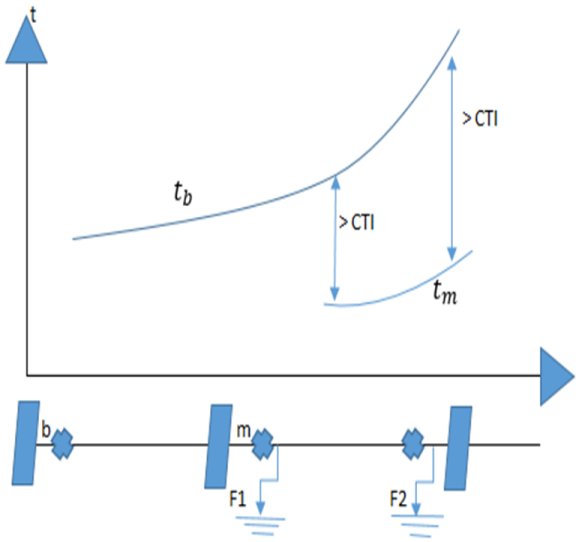

Fig 1. Coordination constrain of overcurrent relay

So the constraint for coordination of OC relays b and m will be like as expression

(1) $$\Delta t_{mb} = t_b(F1) - t_m(F1) - CTI > 0 \quad \text{\_\_\_\_\_ (1)}$$

(2) $$\Delta t_{mb} = t_b(F2) - t_m(F2) - CTI > 0 \text{\_\_\_\_\_ (2)}$$

where the following notations have been used:

(a) CTI is the coordination time interval of both relay and its value to be taken as 0.4 sec.

(b) t_b (F1) and t_m (F1) are the operation time of backup and main relay at fault F1;

(c) t_b (F2) and t_m (F2) are the operation time of backup and main relay at fault F2.

III. PROPOSED APPROACHES

In this paper, genetic contains time setting and plug setting of over current relays. The below objective function is used for finding the grading of Genetic is defined as Equation, take into using reference [9].

$$O.F = \alpha_1 \times \sum t_i{}^m + \alpha_2 \times \sum (\Delta t_{mb} - \beta \times (\Delta t_{mb} - |\Delta t_{mb}|))^N$$

where the following notations have been used:

- Δt_{mb} it is defined as the time difference between main or primary relay and backup relay.
- t_m is defined as the main relay operating time and t_b is the operating time of backup relay.
- CTI is the time interval coordination of and its value take to be 0.24 s.
- β is act as a missed operation of relay.

α1 is used to control the weighting of $(\sum t_i^{\ m})$and α_2 is used to control the weighting of $(\sum \Delta t_{mb})$ This is shown in Fig. To describe the role of the new expression, we consider Δt_{mb} to be positive, then the relative expression $(\Delta t_{mb} - \beta \times (\Delta t_{mb} - |\Delta t_{mb}|))$ will be equal to Δt_{mb}, i.e.

IV. REVIEW OF G.A TO COORDINATION APPLICATION

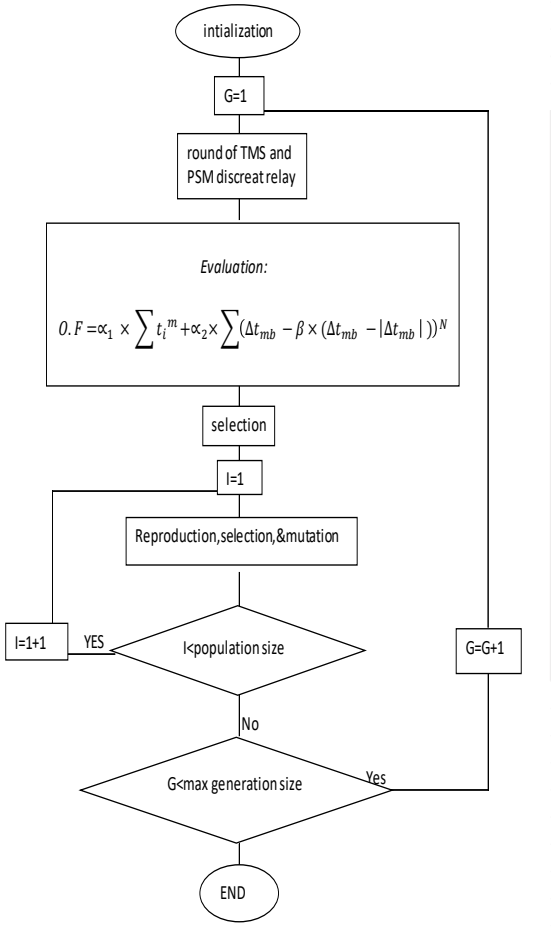

Fig 2. Genetic Algorithm

A. To ensure a high-quality product, diagrams and lettering must be either computer-drafted or drawn using India inkTo give a better understanding, during this section first of take some the review of the notation and concept of GA applied to overcurrent relays coordination is as presented. The flow diagram of the GA as applied to relay coordination is shown in above Fig. step by step description of the flow diagram is given below.

B. The first block of diagram is Initialization it will be present the first "Parents" chromosome pool should be generated by creating several sets of relay settings initially. Each set of relays setting is packed into a chromosome.in this system the total seven genetic with each 3 parents considered. The number of TSM's and PSM's sets is referred as the population size. After each iteration calculation , the new generating Time setting and plug setting is belong to relays 1st to last relay are given to the algorithm. G is the new generating iteration counter and is set to 1 initially.

C. The second term is Evaluation it works as a to evaluate or check the goodness of each chromosome by using the relay grading method, the Objective Function value and the other variables related to it are evaluated.

D. Selection it is a most useful term related to this algorithm According to the calculated OF values of "Parents" at each generation, some parents are more distinct than others parents who have more optimal OF values in the "Parents" chromosome

pool, should be granted more opportunities to survive, so that they can generate more offspring. The roulette wheel selection process could then be used with this enhanced selection list.

E. Reproduction and mutation. The reproduction is responsible for producing offspring value by the genetic operators' crossover and mutation. Checking and evaluating of each new offspring satisfaction is required in order to form the "Children" chromosome pool.

F. In this step, the Selection from "Children" and "Parents" for the next generation. It is basic step of optimization methods to find that the OF value is to one parameter, with large changes are still needed in another parameter to cause significant changes. Genetic Algorithm is also suffering from the same problem. To deal with such inequities constrain, the pre-scaling technique is employed. The OF value of each genetics.

V. SIMULATION AND RESULTS

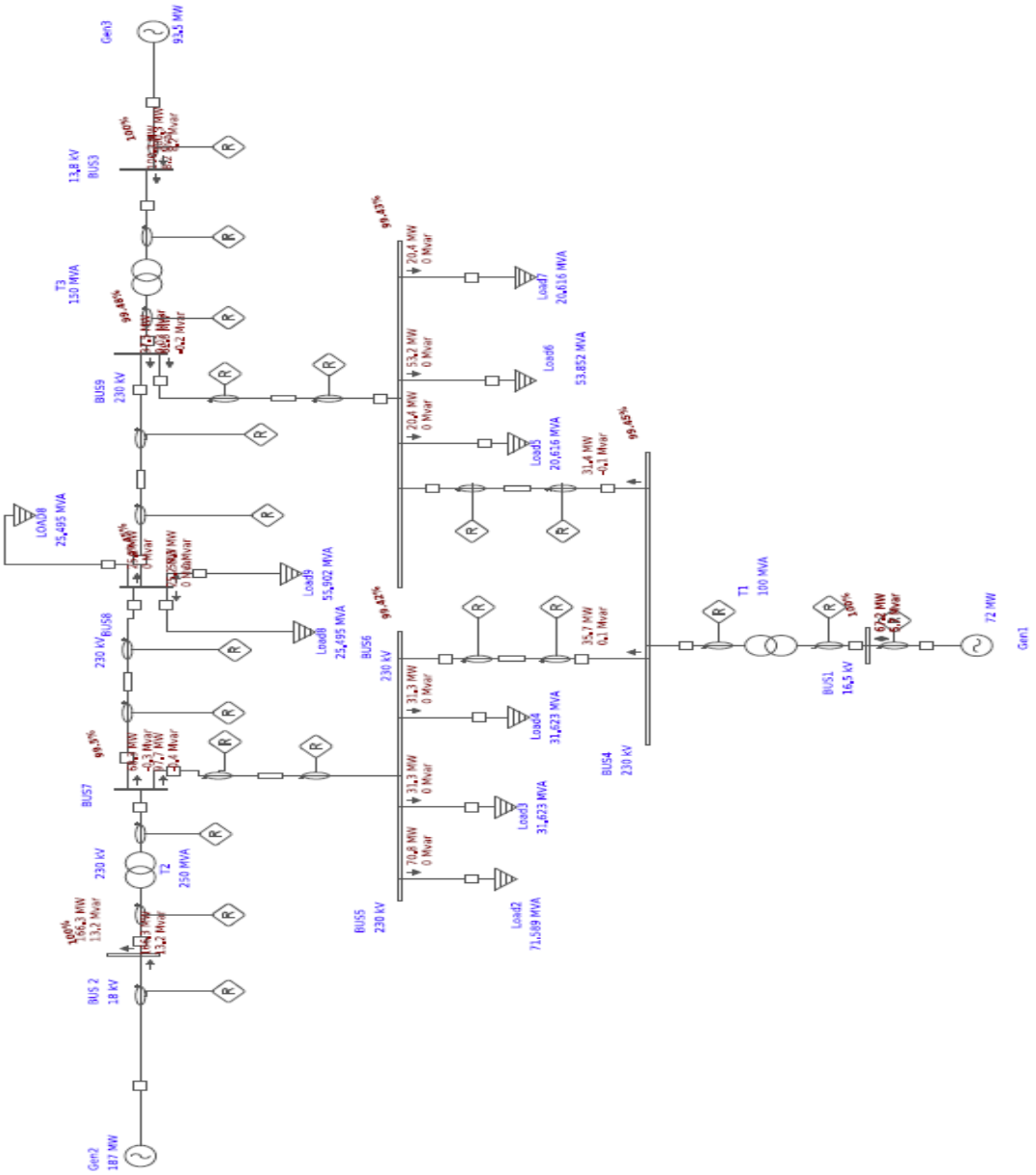

Fig 3. Load flow simulation in ETAP Software

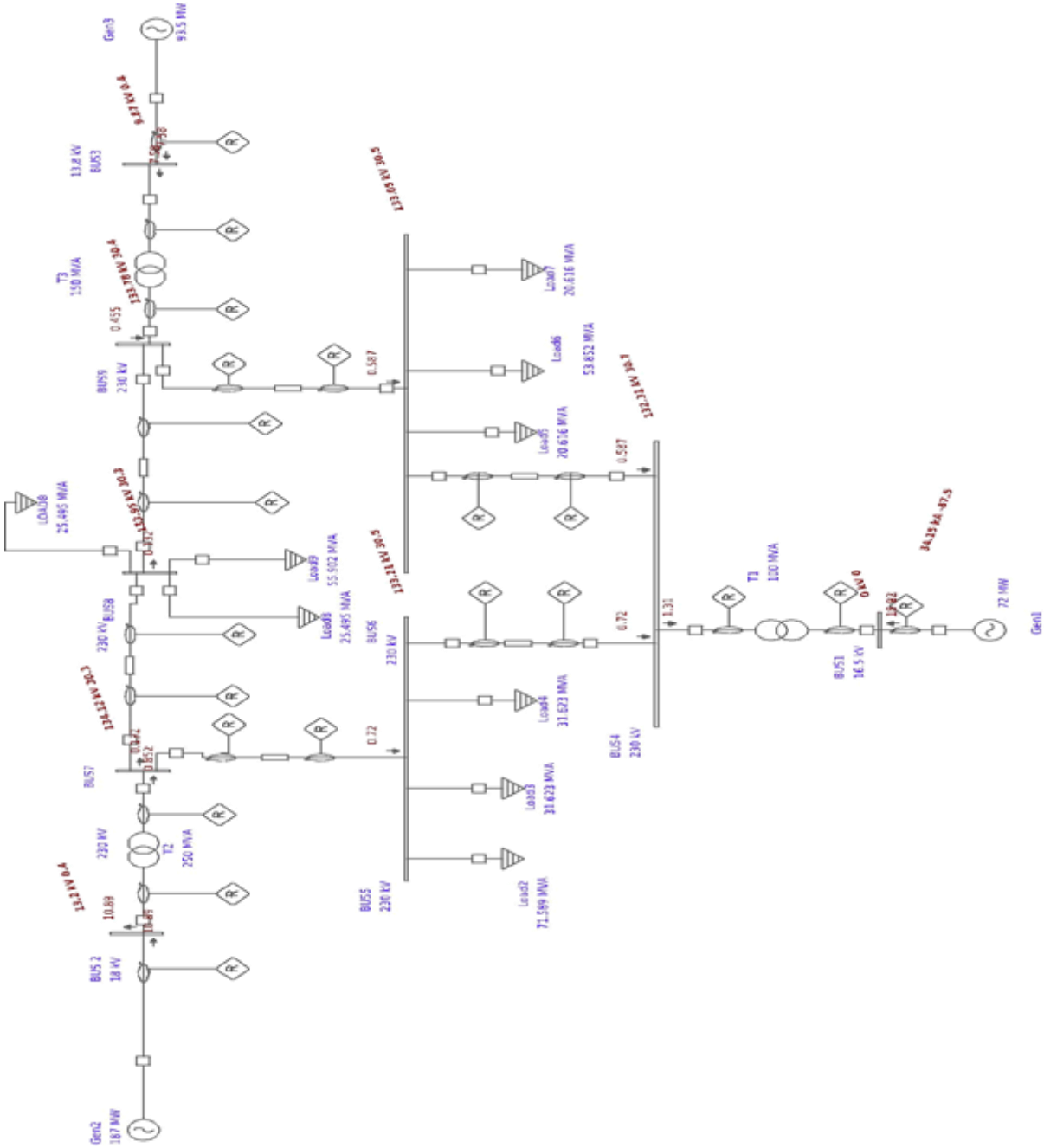

Fig 4. Short circuits simulation in ETAP Software

VI. WORK DONE

(1) Impedance Calculation:

- $\%Z_s = \frac{F_b}{F_{ls}} \times 100\%$

Where, $\%Z_s$ = Percentage impedance of source station

F_b = Base MVA

F_{ls} = Fault level at source station

- $\%Z_t = \frac{F_b}{F_t} \times \%Z_t$

Where, $\%Z_t$ = Percentage impedance of source station

F_b = Base MVA

F_t = Fault level at source station

TABLE I. Fault Level Calculation

Fault at	Bus1	Bus2	Bus3	Bus4	Bus5	Bus6	Bus7	Bus8	Bus9
Fault level	4.7312 MVA	11.57 MVA	4.4186 MVA	4.7312 MVA	6.9940 MVA	5.6717 MVA	7.3333 MVA	6.9940 MVA	6.9940 MVA
Short ckt current	165.50 KA	371.29 KA	184.81 KA	11.87 KA	17.55 KA	14.23 KA	18.40 KA	17.55 KA	17.55 KA

TABLE 2. Primary and Backup Pair of Relay

FAULT POINT	PRIMARY PAIR	BACKUP PAIR
BUS1	R22	R21
	R23	R21
BUS2	R3	R2
BUS3	R10	R9
	R11	R10
BUS4	R18	R17
	R20	R18,R19
	R21	R20
BUS5	R14	R13
	R17	R15
BUS6	R16	R15
	R19	R15
BUS7	R4	R3
	R5	R4
	R13	R3,R6
BUS8	R6	R4,R5
	R7	R5
BUS9	R8	R5
	R9	R8
	R15	R7,R10

VII. CONCLUSION:

In this paper, an optimization method is to be presented to solve the problem of coordinating relays in the power system. The operating time of the relays was determined using GA for IEEE9 bus system for finding grading of Objective Functions. The value of Time Dial setting (TDS) and Pick up current value (Ip) are found for function respectively in such a way that all constraints are satisfied. This method should be increased some number of iteration and speed operation of relays. Finding the absolute optimal point, the ability of relays are some of advantages of the proposed method. The dependency of GA solution on initial condition is weaker and it requires more computing time. These are some limitations of this method

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