

Optimal Parameter Setting for Directional Relay in Multi Machine System

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Abstract: Enhancement of directional over-current protection (DOCR) settings is a basic issue in electrical designing. The advancement model of the issue ends up being non-direct and rather controlled wherein settings especially time dial putting (TDS) and fitting setting (PS) of each hand-off are mulled over as choice factors; the total of the working occasions of all the essential transfers, which are anticipated to work that enables you to clear the issues in their relating zones, is considered as a goal include. In the predominant analyze, demonstrate thought about especially IEEE eight-transport form. To comprehend the problem, we have connected PSO based wellbeing upgrade. The outcomes are as contrasted and the traditional arrangement of guidelines to be had inside the writing; the numerical outcomes demonstrate that the changed calculations outflank or perform at standard with different calculations. In light of the coordination results acquired on this investigations, the proposed molecule swarm enhancement set of principles can be utilized to compute the settings of the directional overcurrent transfers in a distribution community with allotted generation. The proposed set of rules has shown to have the potential to keep selectivity among the relays being coordinated and limit the running times of the primary relays for close-in 3-section faults.

Keywords: Optimization, PSO, DOCR, power system protection

1. Introduction:

Hand-off Coordination in a tremendous dissemination framework with more than one cross sections and bidirectional power feed transforms into Complex for insurance engineers. Manual and diagram rule based methodologies had been executed productively in little power contraction. In a major circulation device direct and non-straight programming based absolutely advancing strategies are actualized for transfer coordination. In this works of art streamlining methods are executed for most appropriate co-appointment of directional overcurrent transfers. This theory talks about the use of Particle Swarm Optimization (PSO) calculation for most worthwhile coordination of DOCR transfers in a 8 transport power machine. Blend of

essential and reinforcement hand-off is chosen by means of the utilization of far and close stop vector of shape, to maintain a strategic distance from mis-coordination of transfers. Coordination of DOCR is inspected for IEEE 8 transport structures the utilization of the PSO. Likewise, the objective trademark is changed to improve the working time among reinforcement and essential transfers. The results are contrasted and the improved estimations of Time dial putting and Plug setting esteems acquired from mainstream conventional methodology. The proposed calculation dependent on PSO offers surest coordination edge and no mis-coordination between number one and reinforcement sets. Results additionally are demonstrated the utilization of recreation created on MATLAB programming.

Low esteem and straightforwardness to execute are the merits of overcurrent transfer programming for circulation gadget insurance. For bidirectional quality float feeders directional sort of overcurrent transfers are utilized for assurance application. In the event that any hand-off neglects to react the blame it's miles supported by each other transfer. The task of first (number one) transfer is short and returned up (optional) hand-off works after a beyond any doubt time edge. In this way, the transfers are set in this sort of style to separate the base broken part of vitality network. Overcurrent transfers are utilized as both essential and reinforcement security for intensely fit and multi-supply control network. Hand-off Coordination in a coincided vitality arrange in very repetitive and time ingesting issue. Prior coordination of directional overcurrent transfers (DOCRs) changed into achieved physically, which transformed into very time eating. The utilization of PC inside the hand-off coordination has remembered assurance building from cumbersome figuring. Essentially there are two systems are utilized for DOCR, traditionally reasoning and parameter streamlining methods. Producing power ought to no longer threaten the environment. It ought to advantage the surroundings in a single manner or the alternative. Over the closing five years non traditional resorces has come to be a

leading renewable strength funding destination [1]. The authorities has incentivized initiatives aimed at addressing the demanding situations of electricity call for, economic increase, the U.S.'s carbon footprint and weather modifications.

Stuck in an unfortunate situation of planning directional over present day transfers in power structures is said and explained inside the system of advancement hypothesis. The proposed strategy decides the "premier" way to deal with this coordination issue in a savvy and green way, by utilizing proclaiming the inconvenience as a parameter advancement issue, and fixing it the use of productive improvement procedures. Here the improvement of Time Dial Setting and limited capacity were given from Linear programming with Large-Scale: Interior Point in Matlab has been executed by method for Particle swarm Optimization strategy coded in MATLAB. It is appropriate to state directly here that the Optimization strategy displayed on this works of art additionally can be connected to the issue of most noteworthy quality coordination of protecting transfers beside directional over present day transfers (e.G. Separation transfers [9]). The enhancement approach and its particularization to the instance of directional over current transfers depend on PSO.

2. Related Work:

Directional transfers are utilized for the insurance of intensity transmission and appropriation frameworks. Such transferring is utilized in number one wellbeing of ring conveyance contraction if indistinguishable criticalness blame forefront streams on both course [1] or in optional assurance in power structures [2]. Transfers region shrewd recognize one of a kind flows by means of a similar blame. This section mindfulness on transfer coordination issue based thoroughly articles evaluation that portrays the methods to decide the hand-off activities wording for variety blame capacity to furnish productive coordination edge with least time delay [3].

The most extreme basic task when putting in directional transfers at the framework is picking their appropriate settings with the end goal that their crucial securing capacity is met underneath the prerequisites of affectability, selectivity, unwavering quality and pace [4]. The over current hand-off coordination in appropriation contraction systems is in all respects colossally requirement improvement issues of pursuing target for advanced vitality machine dependability. A few articles over count of the time dial and get present day ((TDS and Ipu) setting of the transfers is the center of the coordination.

A few written works have proposed inexhaustible innovation which may be thought about as smooth supply of vitality and surest utilization of these recourses limit natural effects, produce the insignificant optional waste and feasible basically dependent on present day and fate financial. These advantages are ordinarily appropriated in nature and immediately coordinated at dissemination stages. Expanding infiltration of the dispensed vitality recourses in dissemination power organize make additional operational and control inconveniences. In this manner new insurance coordination plot are required for providing the sufficient security coordination for administered vitality assets related electric controlled power network. Because of this streamlining of directional over-flow hand-off (DOCR) settings is a vital problem inside the electric quality system. The enhancement rendition of the inconvenience is by all accounts non-straight and truly compelled in which settings especially time dial settings (TDS) and attachment settings (PS) of each transfer are thought about as decision variable; the total of running occurrences of all essential transfers, which can be anticipated to work a decent method to clean the blame in their relating zones is contemplated as target work. In present watch, three models are contemplated to be specific IEEE-three transport demonstrate, IEEE-4 transport model and IEEE-6 bus version. The purpose of this review is discover the destiny scope of relay coordination application for dispensed strength sources related distribution system.

3. Methodology:

The finest coordination hassle of DOCRs the use of optimization method comprises of limiting a goal work (execution work) issue to certain coordination criteria and limits on inconvenience factors. The transfer, which should work first to clean the blame, is alluded to as the essential hand-off. A blame near transfer is known as the close in blame for the hand-off and a blame at the other quit of the line is known as a far-transport blame for the hand-off. Ordinarily, objective capacity in coordination inquire about is established in light of the fact that the summation of working occasions of all essential transfers, reacting to clean all shut in and far transport issues. The objective component is portrayed as pursues:

Minimize $\sum_{i=1}^{N_{cl}} T_{pri_cl_in}^i + \sum_{j=1}^{N_{far}} T_{pri_for_bus}^j$ OBJ = (1)

where, N_{cl} is number of relays responding for close-in fault. N_{far} is stature of relays responding for far-bus fault. $T_{pri_cl_in}$ is primary relay operating time for close-in fault. $T_{pri_for_bus}$ is primary relay operational time for far-bus fault. The constraints are as follows:

- (1) Bounds on variables TDSs
 $TDS_{min}^i \leq TDS^i \leq TDS_{max}^i$, where i varies from 1 to N_{cl} .
 TDS_{min}^i is the lower limit and TDS_{max}^i is the upper limit of TDS^i
 These limits are 0.05 and 1.1, respectively.
- (2) Bounds on variables PSs
 $PS_{min}^i \leq PS^i \leq PS_{max}^i$, where i varies from 1 to N_{cl} .
 PS_{min}^i is the lower limit and PS_{max}^i is the upper limit of PS^i
 These are 1.25 and 1.50, respectively.
- (3) Limits on primary operation times
 This constraint imposes constraint on each term of objective function to lie between 0.05 and 1.0.
- (4) Selectivity constraints for all relay pairs
 $T_{backup} - T_{primary} - CTI \leq 0$
 T_{backup} is the operating time of backup relay, $T_{primary}$ is operating time of main relay and CTI is coordinating time interval.

A. Model 1—the IEEE 8-bus model

For the association issue of IEEE 8-transport demonstrate, estimation of everything about and N_{far} is 14 (equivalent to number of transfers or twofold the lines). As needs be, there are 28 choice factors (two for each transfer) in this issue for example $TDS_1 - TDS_{14}$ and $PS_1 - PS_{14}$. The 8-transport framework can be pictured as appeared in Fig. 1. Target work (OBJ) to be limited as given by.

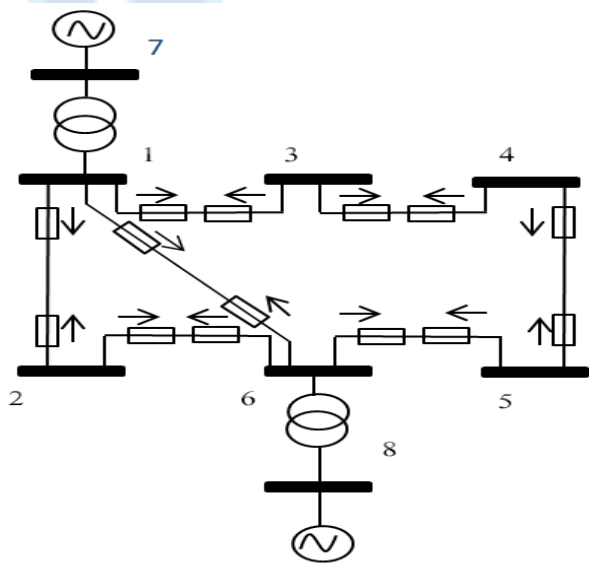


Fig. 1. Eight Bus System.

$OBJ = \sum_{i=1}^6 T_{pri_cl_in}^i + \sum_{j=1}^6 T_{pri_for_bus}^j$ (2)

Where

$T_{pri_cl_in}^i = \frac{0.14 * TDS^i}{(\frac{a^i}{PS^i * b^i})^{0.02} - 1}$ (3)
 $T_{pri_cl_in}^i = \frac{0.14 * TDS^j}{(\frac{c^i}{PS^i * b^i})^{0.02} - 1}$ (3.5)

The values of a^i, b^i, c^i and d^i are constant. constraint for the model boundaries on variables TDSs

$TDS_{min}^i \leq TDS^i \leq TDS_{max}^i$, where, i varies from 1 to $14(N_{cl})$

Bounds on variables PSs:

$PS_{min}^i \leq PS^i \leq PS_{max}^i$, where, i varies from 1 to $14(N_{cl})$

Limits on primary operation times:

This restraint imposes constraint on each term of objective function to lie between 0.05 and 1.0. Selectivity constraints are

$T_{backup}^i - T_{primary}^i - CTI \geq 0$ (4)

T_{backup} is the operating time of backup relay and $T_{primary}$ is the operating time of primary relay. Value of coordinating time interval (CTI) is 0.3. Here

$T_{backup}^i = \frac{0.14 * TDS^p}{(\frac{e^i}{PS^p * f^i})^{0.02} - 1}$ (5)

$T_{primary}^i = \frac{0.14 * TDS^q}{(\frac{g^i}{PS^q * h^i})^{0.02} - 1}$ (6)

The p, q, e^i, f^i, g^i and h^i are constants.

In Fig. 2, x_1, x_2 and x_3 all have difference distance from itself to global best position. x_1 drops within the radius of $(0.5 - ac) * FD_d$. The distance from x_2 to global best position is between $(0.5 - ac) * FD_d$ and $(0.5 + ac) * FD_d$. x_3 drops beyond the radius of $(0.5 + ac) * FD_d$ in DAPSO1. In DAPSOs, we define the “long distance” as the distance from the particle to the global best beyond $(0.5 + ac) * FD_d$ and the “short distance” as the distance from the particle to the global best is smaller than $(0.5 - ac) * FD_d$. In DAPSO1, The particles a long way far from the worldwide high-quality must take delivery of larger price of velocity so it may discover an unknown region, while those near the worldwide first-rate ought to receive smaller value of speed so that it is able to make the most the neighborhood of the worldwide high-quality.

In DAPSO2, if there had been many debris far far from the worldwide pleasant function, then the velocities should be given a larger fee. If there were many particles near from the global great position, then the velocities should be given a smaller cost. DAPSO1 most effective adjusts the rate of the positive particle, however in DAPSO2, the velocities of all particles are adjusted collectively.

The preferred go with the flow of DAPSOs and the flowchart of DAPSO are proven as follows.

Step 1. Initialization of a population of particles with random positions and velocities

Step 2. Evaluation of particles.

Step 3. Calculate the distance from each particle to the global best position and save the farthest distance in the memory.

Step 4. Adjust particle's velocity according to its distance from itself to the global best position.

Step 5. Update particle's position by the adjusted velocity.

Step 6. Repeat Step.2~Step.5 until termination criteria are met.

4. Result and Discussion:

The people group of this check case is demonstrated in the parent given underneath, wherein the near stop 3φ blame is considered. Transport four is associated with an outside network this is displayed by utilizing 400 MVA brief-circuit potential. Some examination named this machine as a 6-transport investigate machine, because of the reality transport 7 and transport eight are identified with the creating gadgets and do now not have any hand-off. The to be had set of the discretized plug-setting (PS) is 0.5,0.6,0.8,1.0,1.5,2,2.5. In spite of the fact that this check case has little measurement, it's been seen that it is extremely hard to get possibly and most gainful solution. The CT proportions (CTRs) and the 3φ cut off day for every P/B pair of transfers are given underneath

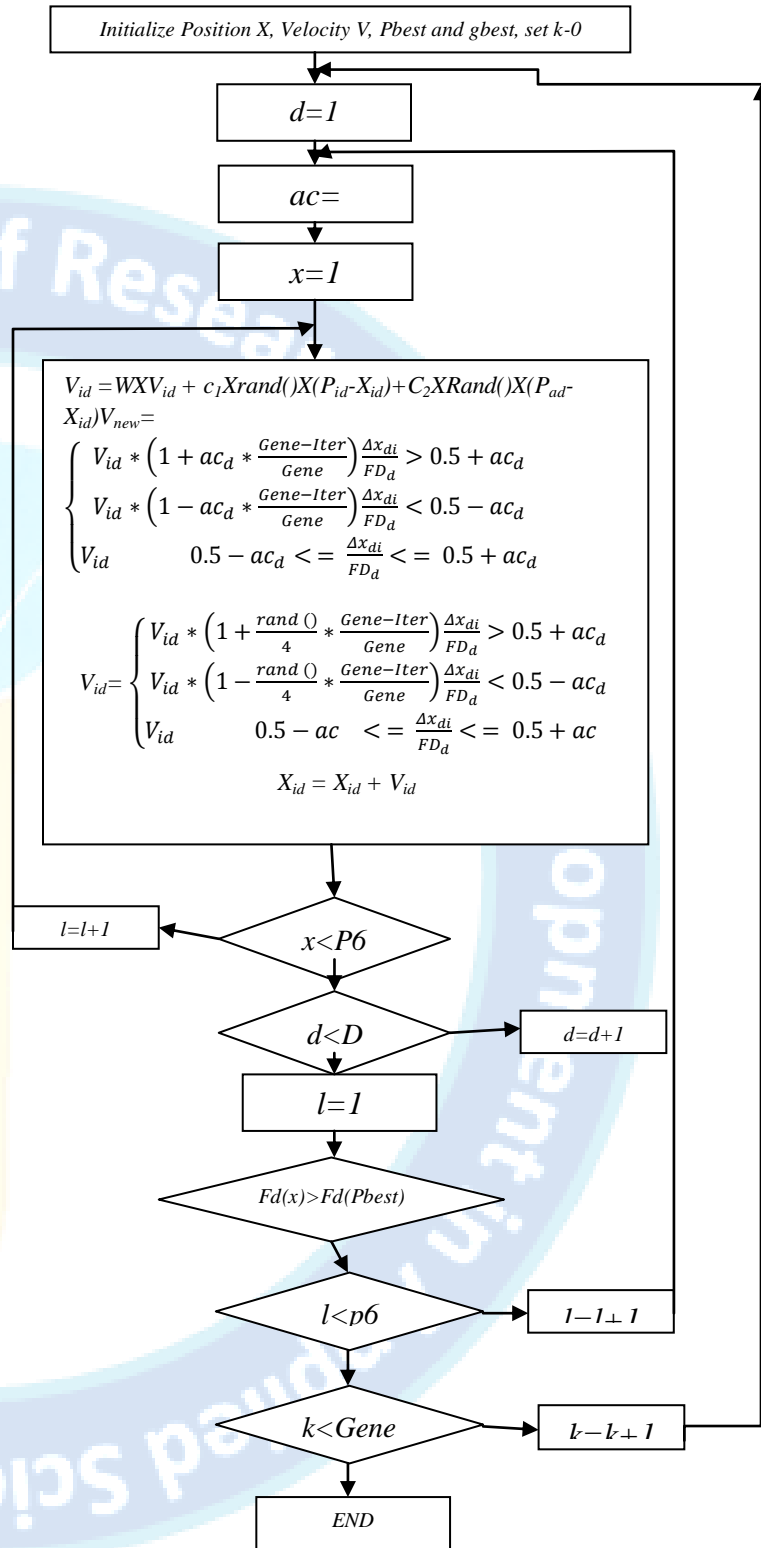


Figure 2: Flowchart of DAPSO.

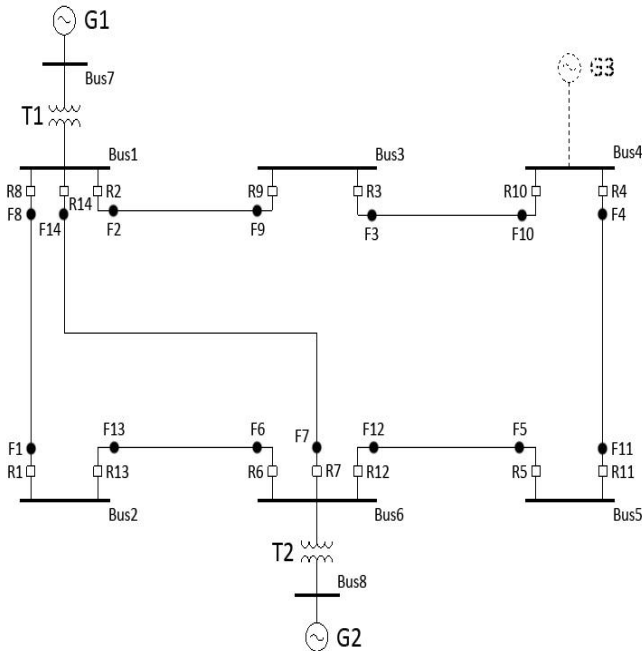


Figure 3: 8 Bus system

The optimization process is run for 100 iterations and the final value of above mentioned fitness function is observed to be decreasing as shown in figure.

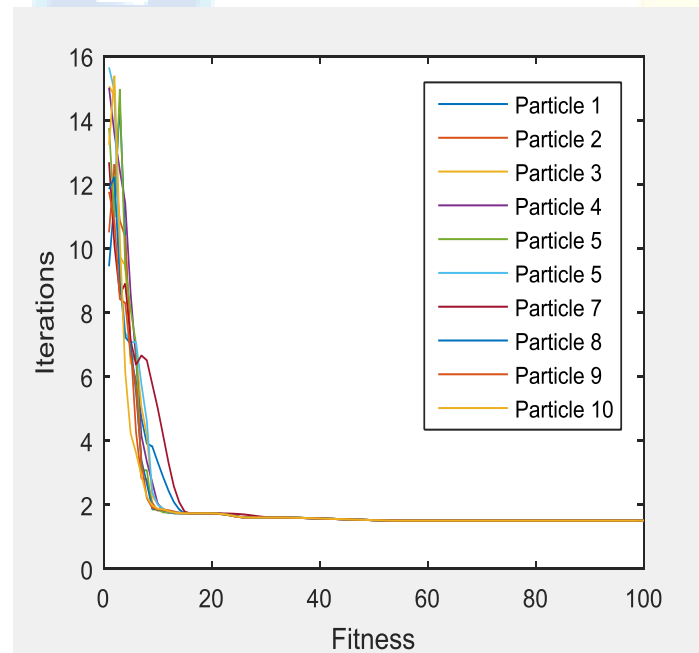


Figure 4: Convergence plot of PSO fitness cost function.

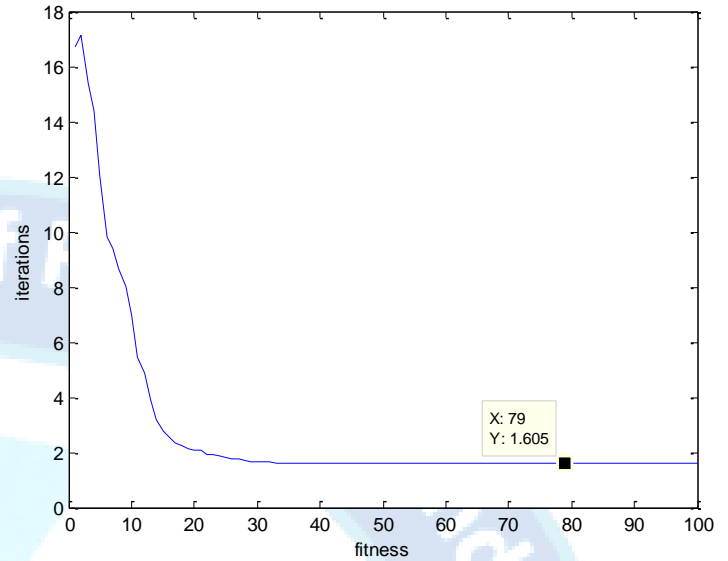


Figure 5: Convergence plot of PSO average fitness cost function.

After the finish of optimization process the optimized solution in terms of TDS and PS are shown in figure 6.

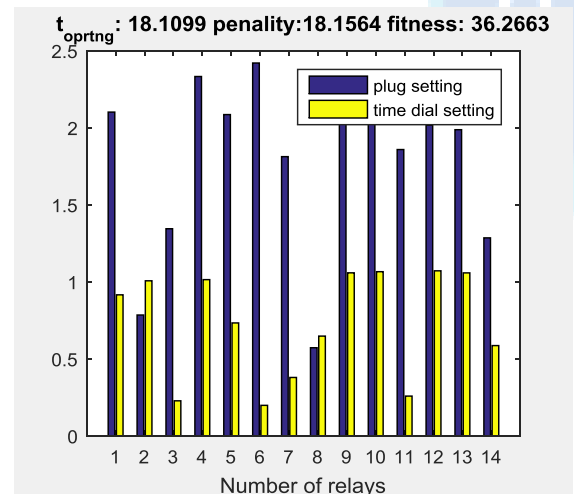


Figure 6: Penalty time and plug setting value for all relays

5. Conclusion:

Coordination of directional over-flow hand-off (DOCR) is an oftentimes emerging issue in the field of electrical designing, which can be detailed as a streamlining issue. The numerical model of the issue is exceptionally mind bogging and non-direct in nature, subject to different imperatives, and requires refined improvement procedures for its answer. In this work, an endeavor is made to illuminate the IEEE 8-



transport show with the assistance of advancement approach and with changed wellness condition rendition. Improved variants recommended here consider time and punishment limitations both and used to take care of the previously mentioned DOCR issue. Observational investigation of numerical outcomes gotten by PSO plans and ordinary calculations demonstrate the ability of the proposed calculations. Besides PSO streamlining plans require just a single control parameter for example the hybrid rate, though the vast majority of different strategies have more than one control parameters, which are to be tweaked for the fruitful execution of a calculation. Among the PSO, the calculation configuration would require the utilization of quick combination approach for tackling the mind boggling kind of issues referenced in the present examination.

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