Application Method Algorithm Genetic Optimal To Reduce Losses In Transmission System

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Abstract—**The use of genetic methods optimization on transmission system has a simple basic principle. The main principle do of optimizing the fitness function to obtain the minimum fuel consumption. Implementation is done on the system 5 bus IEEE which gives the results of the differences before and after the optimization process. The primary objective of optimization process is to obtain of loss smallest possible system with fuel costs as small as possible. Based on calculations visible that after the optimization process happen to decline loss from system. Large changes Decrease system losses can Described as follows. Big the changes of decrease to losses before optimization are calculated using the analysis power flow Newton_Raphson method with the results of 3.052 MW, while using genetic algorithms optimal and produce losses on system as big as 2,671MW with the best fitness value of $ 1,600 / hour.**

Keywords: Genetic Algorithm Optimal, the Loss System, Value Fitnes

I. INTRODUCTION

The development and progress of solving technique using genetic algorithms is very rapid. The main advantage of the completion of the genetic algorithm among others with modeling which easy to do and flexible, especially for models with nonlinear constraints, it is easy in coding and the use of the processing capacity of the CPU can be reduced [1,2].

Completion of optimal power flow using a genetic algorithm provides the knowledge and technology which directly cause the calculation to be effective and practical as well as better working voltage [3,4]. The application of evolutionary methods such as genetic algorithms for optimal power flow also provide better system performance and can solve very complex optimization problem with a simple algorithm, but with a better outcome [5,6]. The power flow optimal to use genetic algorithm simple can describe effect of the from variable which controlled. So as can to accelerate convergence, the calculation time and a decrease in costs and loss system than the classical approach as Langrange multiplier and differential evolution to be effective can provide system solutions in normal circumstances and in a state of impaired [7,8,9]. Optimal Power Flow (OPF) is a calculation to minimize an objective function, namely the generation cost or transmission losses by regulating the active power and reactive power of each generator of the power systems which are interconnected by observing certain limits. Methods of optimal power flow calculation can also be used to determine the value of parameters in every bus system in the form of bus voltage, electrical power, electric current, and the magnitude of the phase angle.

The problem to determine the power flow optimization using a genetic algorithm with a coefficient of system loss is minimized with the lowest cost of electricity generation and with transmission losses constitute discussion in this paper.

1.1 Problem Formulation

Problem Formulation of this study is, whether can determine the power flow optimization using a genetic algorithm with a coefficient of system loss is which minimized with the generation cost lowest and transmission losses?

II. LITERATURE

The formulation of the fitness function to minimize the cost of generation and losses network can be described as follows.

2.1 Function minimize for the production cost lowest:

$$F(x) = \min \sum_{i=1}^{ng} a_i \, Pg_i^2 + b_i P_{gi} + c_i$$

With limits:

$$Pg_i^{min} < Pg_i < Pg_i^{max}$$

Where,

i = 1, 2, 3 .... ng, ng is the number of generator (plant) including of the slack bus.

Pgi is the active power at bus i.

ai, bi, ci are the unit of costs curve for the generator.

2.2 Constraints Equation

While minimizing the cost function, it is necessary to make sure that the generator to supply the load demand (Pd) plus losses in the transmission path. Usually the power flow equations are used as a constraint equation is:

Equations of power flow on the network:

g (V, φ) = 0

Where:

$$g\,(V, \phi) = \begin{Bmatrix} P_i\,(V, \Phi) - P_i^{net} \\ Q_i\,(V, \Phi) - Q_i^{net} \\ P_m\,(V, \Phi) - P_m^{net} \end{Bmatrix}$$

2.3 Inequality Constraints

Inequality constraints of the OPF reflect the limits on physical devices in power systems as well as the limits which created to ensure system security. The most frequently contained on the inequality constraints is are upper limits on generator bus voltages and load buses, a lower voltage limit at some bus generator, the maximum load limit on the channel and tap settings.

Inequality constraints on the problem variables considered, include:

a. Inequality constraints on reactive power on each bus Qgi PV is:

$$Qg_i^{min} \leq Qg_i \leq Qg_i^{max}$$

Where:

Qgimin and Qgimax is the minimum and maximum values of each reactive power on PV bus i.

b. Inequality constraints on the magnitude of the voltage V at each bus PQ is:

Where:

Vimin and Vimax is the value minimum and value maximum of voltage at bus i.

c. Inequality constraints on phase angle of ϕ on the voltage in each bus i is:

Where:

ϕimin and ϕimax is the velue minimum and value maximum from the phase angle at bus i.

The Limit of flow MVA on the transmission line is:

Where:

MVAijmax is the maximum value of the transmission line connected to the bus i and j.

2.4 Formulation Optimal Power Flow the for the losses of transmission

Losses of power active and reactive power occur on the transmission line depends on electric power to be transmitted. For the losses of network:

$$P_l = \sum_{i}^{n}\sum_{j}^{n} B_{ij}\,P_iP_j + \sum_{i=1}^{n} B_{0i}P_i + B_{00}$$

If the network has a bus m electricity flow equation is written as follows:

$$P_i = Real\left(\sum_{j=1}^{m} V_i\,(V_i^* - V_j^*)Y_{ij}^*\right),$$

$$Q_i = I_{mag}\left(\sum_{j=1}^{m} V_i\,(V_i^* - V_j^*)Y_{ij}^*\right),$$

$$i = 1, 2, \ldots m$$

His limit:

$$V_i^{min} \leq V_i \leq V_i^{max}$$

III. RESEARCH METHODOLOGY

In general the calculation steps of this method can be described on the following flow analysis in Figure 1.

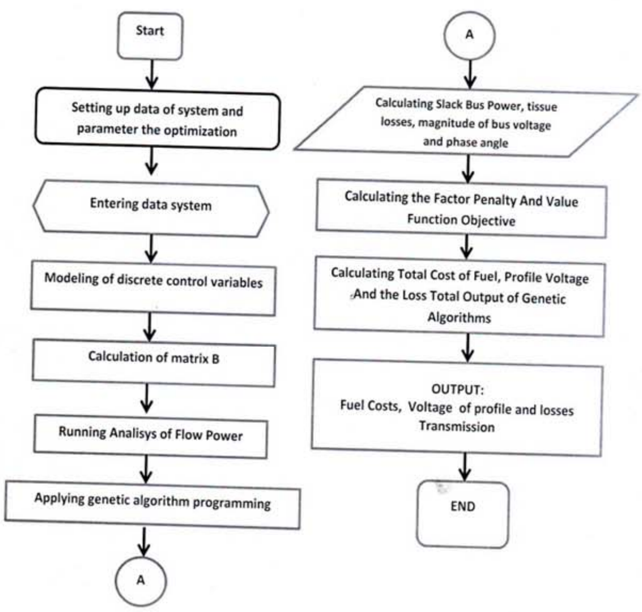

Figure 1 Flowchart Step Calculation

Step by Step analysis of the system in general can be explained as follows.

1. Setting up data of system and parameter of optimization for system optimization problem IEEE 5 bus.
2. Shape Y bus with sparsity techniques, form matrix slope constant [B '] with using Cholesky decomposition.
3. Modeling discrete control variables (Taps and shunt) and randomly generates the members of the population denan currently in with within the limits of their variables.
4. Modify the elements Y into the Taps, element shunt bus to the Taps and with values element Y bus that is updated based of matrix slope of [B '] and decompose using Cholesky decomposition.
5. Run the power flow.
6. Application of algorithms programming genetic.
7. From the convergence of power flow solution, it can be calculated slack bus power, losses of network, magnitude of voltage bus and phase angle.
8. Initialize the penalty factor and calculate the penalty factor.
9. Counting individual generation from generators and fuel costs that fit together with the total cost of fuel, voltage profiles, and a total loss.

Steps Method Genetic Algorithm Optimal Power of Flow can be explained as follows.

1. Initialization: Generate initial population randomly with size N and i = 0.
2. Determine the Value of Fitness: Evaluate the fitness value for each of the population based on the value of the objective function. If the criteria have been met, then the search is stopped and displays the results then go to step 4.
3. Crossover: To produce offspring with using crossover, then randomly selected two parents from the initial population and then produce two ancestry with using operator of crossover.
4. Mutation: This operator randomly selected one solution the parents of the initial population and applying the mutation operator to produce a single offspring.
5. Selection: Select solusition N from population which resulting and the population which old based on the value fitness. Set-generation i = i + 1. Continue to step 2.

Next depicted on Figure 2.

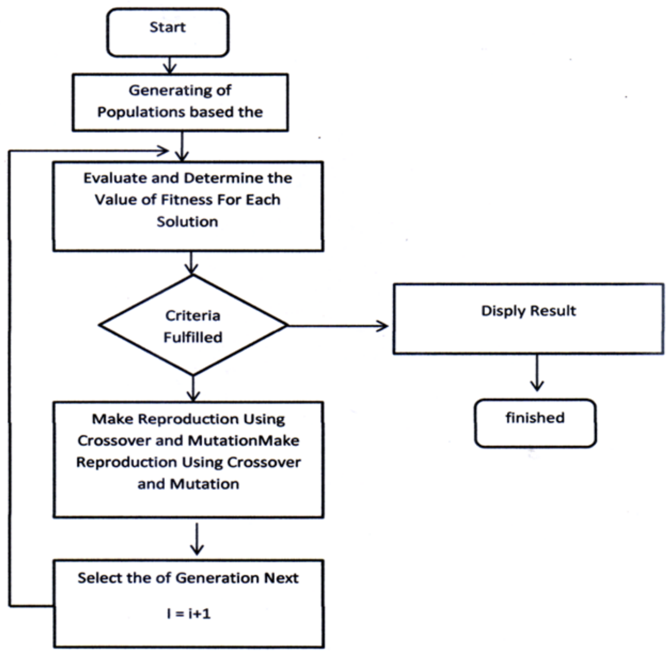

Figure 2. Methods Genetic of Algorithm Optimal

IV. RESULTS AND DISCUSSION

The result of the calculation using method genetic of algorithms optimal can be seen as follows. The output for fuel costs, F = $ 1,600 / hr,

While the matrix calculation for:

P1 = [32.1624 64.6309 55.8779]

Large of production to the generator 1,

Pl = 2.6712 MW

The use of time during the simulation was 2:41 seconds.

The result of the calculation of load flow analysis using Newton-Raphson method, can be seen as follows.

Table 1. Results of Analysis Method of Newton-Raphson

Bus	Volt	deg	LOAD		GEN	
			MW	MVAR	MW	MVAR
1	1.06	0.00	0.00	0.00	83.05	7.27
2	1.04	-1.78	20.00	10.00	40.00	41.81
3	1.03	-2.66	20.00	15.00	30.00	24.14
4	1.01	-3.24	50.00	30.00	0.000	0.00
5	0.99	-4.40	60.00	40.00	0.000	0.00
Total			150.00	95.000	153.051	73.230
Total losses of system (MW)						3.052
Maximum Power Mismatch						0,00001

Based of result on calculations using the method Newton-Raphson resulting losses of network of as big as 3,052 MW.

The result of the calculation of the component matrix B, B0 and B00, becomes a very important parameter for analysis. This parameter is used to calculate the optimal method of genetic algorithms.

This parameter is used to calculate method of genetic algorithms optimal. Figure 3 shows results the output of display from best fitness to search randomly (random) to get the best results.

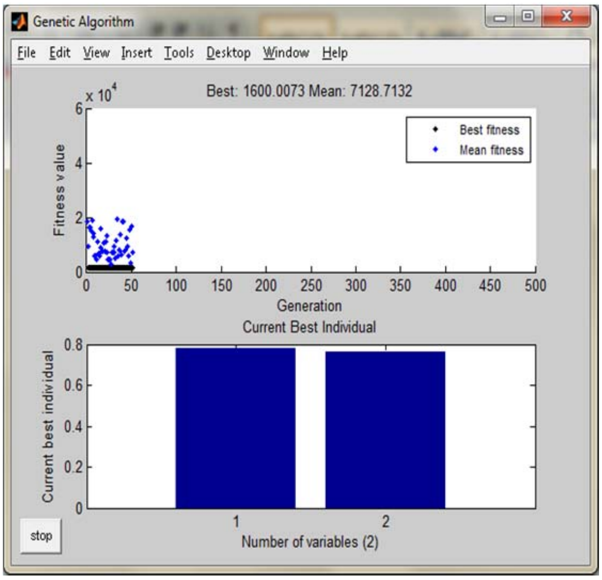

Figure 3. Result Output Method GA

Based on the above calculation of the output can be seen that the cost of the fuel produced is F = $ 1,600 / hr, as well as losses resulting network of 2,671 MW. On the basis of the calculation can be seen that the genetic algorithm method produces better output than the Newton-Raphson method.

V. CONCLUSION

Based on the results and discussion, it can be concluded that the application of method genetic of algorithms optimal was able to get the best fitness as big as $ 1,600 / hr which resulted in a decrease the losses of system before optimization 3.052 MW into 2,671 MW.

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