LAMPIRAN

1. Source Code

```
tic
clear
clc
N = 50;
maxit = 100;
dim = 1;
c1 = 1;
c2 = 1;
r1 = rand;
r2 = rand;
sumbu_x = [];
sumbu_y = [];

utility = input('apakah utility on ? 1 =on, 0 =off')


if utility == 1;
    FLA_R1 = 97.85;
    FLA_R2 = 97.85;
    FLA_Ru = 100;
end
```

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```
   lwbnd_R1 = 0.1 ;    upbnd_TDS_R1 = 11;

   lwbnd_R2 = 0.1;          upbnd_TDS_R2 = 11;

   lwbnd_Ru = 0.1;     upbnd_TDS_Ru = 11;




%-----------Initializing swarm and velocities----------------------------

% Batasan TDS

xTDS_R1= rand(N,dim)*(upbnd_TDS_R1-lwbnd_R1) + lwbnd_R1;

lwbnd_TDS_R1 = lwbnd_R1;


xTDS_R2= rand(N,dim)*(upbnd_TDS_R2-lwbnd_R2) + lwbnd_R2;

lwbnd_TDS_R2 = lwbnd_R2;


xTDS_Ru= rand(N,dim)*(upbnd_TDS_Ru-lwbnd_Ru) + lwbnd_Ru;

lwbnd_TDS_Ru = lwbnd_Ru;




% Batasan Iset
```

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```
xIp_rele1 = (round((rand(N,dim)*(1.4*FLA_R1-1.05*FLA_R1) +
1.05*FLA_R1)/10)*10);
lwbnd_Ip_1 = (round((1.05*FLA_R1)/10))*10 ;upbnd_Ip_1 =
(round((1.4*FLA_R1)/10))*10;

xIp_rele2 = (round((rand(N,dim)*(1.4*FLA_R2-1.05*FLA_R2) +
1.05*FLA_R2)/10)*10);
lwbnd_Ip_2 = (round((1.05*FLA_R2)/10))*10; upbnd_Ip_2 =
(round((1.4*FLA_R2)/10))*10;

xIp_releu = (round((rand(N,dim)*(1.4*FLA_Ru-1.05*FLA_Ru) +
1.05*FLA_Ru)/100)*100);
lwbnd_Ip_u = (round((1.05*FLA_Ru)/100))*100; upbnd_Ip_u =
(round((1.4*FLA_Ru)/100))*100;



vIp = zeros(N,dim);
% Beban Inersia
rhomax=0.9;rhomin = 0.4;

if utility == 1
   bus2 = 1000;
```

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```
bus3 = 1000;
bus4 = 1000;
bus5 = 1000;
bus = input('pilih bus yang akan diberi fault   ')
if bus == 1
 I_rele_1 = 598 %Isc Max
 I_rele_2 = 598 %Isc Max
 I_rele_u = 1360 %Isc Max


 Iscmin_R1 = 351;
 Iscmin_R2 = 351;
 Iscmin_Ru = 869;



end



end
```

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```
xIp1 = xIp_rele1;
xTDS1 = xTDS_R1;
vTDS1 = zeros(N,dim);
vIp1 = zeros(N,dim);

xIp2 = xIp_rele2;
xTDS2 = xTDS_R2;
vTDS2 = zeros(N,dim);
vIp2 = zeros(N,dim);

xIpu = xIp_releu;
xTDSu = xTDS_Ru;
vTDSu = zeros(N,dim);
vIpu = zeros(N,dim);


% CT tiap rele
CT_R1 = 200
CT_R2 = 800
```

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```
    CT_Ru = 800


waktu_Rele_1 = 0;
waktu_Rele_2 = 0;
waktu_Rele_u = 0;


for it=1:maxit;
    rho=rhomax-((rhomax-rhomin)/maxit)*it ;
%     rho = 1 ;
    %%setting rele 1

    if  bus == 1 || bus2 == 1 || bus4 == 1 || bus5 == 1
        if it == 1
            xIp1 = xIp_rele1;
            xTDS1 = xTDS_R1;
        else
            for q = 1:N
                vTDS1(q,:) = rho.*vTDS1(q,:) + (c1*r1*(PbestTDS1(q,:) -
xTDS1(q,:))) + (c2*r2*(GbestTDS1 - xTDS1(q,:)));
                vIp1(q,:) = (round((rho.*vIp1(q,:) + (c1*r1*(PbestIp1(q,:) - xIp1(q,:))) +
(c2*r2*(GbestIp1 - xIp1(q,:))))/10))*10;
```

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```
        xTDS1(q,:) = xTDS1(q,:) + vTDS1(q,:);

        xIp1(q,:) = xIp1(q,:) + vIp1(q,:);


        if  xTDS1(q) < lwbnd_TDS_R1;

            xTDS1(q) = xTDS1(q) - vTDS1(q);

        end

        if  xIp1(q) < lwbnd_Ip_1 || xIp1(q) > upbnd_Ip_1

            xIp1(q) = xIp1(q) - vIp1(q);

        end


     end

end


T1 = [];

for i = 1:N;

    for j =1:N;

        T_1 = 0.14*xTDS1(i)/(1*(((I_rele_1/xIp1(j))^0.02)-1));

        T1 = [T1;T_1];

    end

end

PbestTDS1 = xTDS1;

PbestIp1 = xIp1;

if  bus == 1
```

```
    To = 0.1 ;
elseif bus3 == 1
    To = 0.1 ;
elseif bus2 == 1
    To = 0.1;
elseif bus4 == 1
    To = 0.1;
elseif bus5 == 1
    To = 0.1;
end
a = abs(To - T1);
[nilaimin,posisimin]=min(a);
for i = 1:N*N
    if a(i,:) == 0
        posisimin = i;
        break
        GbestTDS1 = PbestTDS1(fix((posisimin-1)/N)+1);
        GbestIp1 = PbestIp1(posisimin-(fix((posisimin-1)/N))*N);
    end
end
GbestTDS1 = PbestTDS1(fix((posisimin-1)/N)+1);
GbestIp1 = PbestIp1(posisimin-(fix((posisimin-1)/N))*N);
waktu_R1 = T1(posisimin);
```

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```
        tap_h_R1 = (fix(((0.8 * Iscmin_R1)/CT_R1)*10-0.001))/10;
        if tap_h_R1 > 15
            tap_h_R1 = 15;
        end

    else
        waktu_R1 = 0;
        GbestTDS1 = 0;
        GbestIp1 = 0;
        tap_h_R1 = 0;
    end
    setting_TDS1 = GbestTDS1;
    setting_Ip1 = GbestIp1;
    Tap_1 = setting_Ip1/CT_R1;
    waktu_Rele_1 = waktu_R1 ;

%setting rele 2

    if  bus == 1 || bus2 == 1 || bus4 == 1 || bus5 == 1
        if it == 1
            xIp2 = xIp_rele2;
            xTDS2 = xTDS_R2;
        else
```

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```
            for q = 1:N
                vTDS2(q,:) = rho.*vTDS2(q,:) + (c1*r1*(PbestTDS2(q,:) -
xTDS2(q,:))) + (c2*r2*(GbestTDS2 - xTDS2(q,:)));
                vIp2(q,:) = (round((rho.*vIp2(q,:) + (c1*r1*(PbestIp2(q,:) - xIp2(q,:))) +
(c2*r2*(GbestIp2 - xIp2(q,:))))/10))*10;
                xTDS2(q,:) = xTDS2(q,:) + vTDS2(q,:);
                xIp2(q,:) = xIp2(q,:) + vIp2(q,:);

                if  xTDS2(q) < lwbnd_TDS_R2;
                    xTDS2(q) = xTDS2(q) - vTDS2(q);
                end
                if  xIp2(q) < lwbnd_Ip_2 || xIp2(q) > upbnd_Ip_2
                    xIp2(q) = xIp2(q) - vIp2(q);
                end
            end
        end

                T2 = [];
                for i = 1:N;
                    for j =1:N;
                        T_2 = 0.14*xTDS2(i)/(1*(((I_rele_2/xIp2(j))^0.02)-1));
                        T2 = [T2;T_2];
                    end
```

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```
    end
    PbestTDS2 = xTDS2;
    PbestIp2 = xIp2;
    if  bus == 1
        To = waktu_Rele_1 + 0.2 ;
    elseif bus2 == 1
        To = waktu_Rele_1 + 0.2 ;
    elseif bus2 == 1
        To = 0.3 ;
    elseif bus5 == 3
        To = 0.3 ;
    end
    a = abs(To - T2);
    [nilaimin,posisimin]=min(a);
    for i = 1:N*N
        if a(i,:) == 0
        posisimin = i;
        break
break
        GbestTDS2 = PbestTDS2(fix((posisimin-1)/N)+1);
        GbestIp2 = PbestIp2(posisimin-(fix((posisimin-1)/N))*N);
        end
    end
```

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```
        GbestTDS2 = PbestTDS2(fix((posisimin-1)/N)+1);

        GbestIp2 = PbestIp2(posisimin-(fix((posisimin-1)/N))*N);

        waktu_R2 = T2(posisimin);

        tap_h_R2 = (fix(((0.8 * Iscmin_R2)/CT_R2)*10-0.001))/10;

        if tap_h_R2 > 15

            tap_h_R2 = 15;

        end

else

    waktu_R2 = 0;

    GbestTDS2 = 0;

    GbestIp2 = 0;

    tap_h_R2 = 0;

end

setting_TDS2 = GbestTDS2;

setting_Ip2 = GbestIp2;

Tap_2 = setting_Ip2/CT_R2;

waktu_Rele_2 = waktu_R2;


%%setting rele utility


if bus == 1 || bus2 == 1 || bus4 == 1 || bus5 == 1

    if it == 1

        xIpu = xIp_releu;
```

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```
        xTDSu = xTDS_Ru;
    else
        for q = 1:N
            vTDSu(q,:) = rho.*vTDSu(q,:) + (c1*r1*(PbestTDSu(q,:) - xTDSu(q,:))) + (c2*r2*(GbestTDSu - xTDSu(q,:)));
            vIpu(q,:) = (round((rho.*vIpu(q,:) + (c1*r1*(PbestIpu(q,:) - xIpu(q,:))) + (c2*r2*(GbestIpu - xIpu(q,:))))/10)*10);
            xTDSu(q,:) = xTDSu(q,:) + vTDSu(q,:);
            xIpu(q,:) = xIpu(q,:) + vIpu(q,:);
            if xTDSu(q) < lwbnd_TDS_Ru;
                xTDSu(q) = xTDSu(q) - vTDSu(q);
            end
            if  xIpu(q) < lwbnd_Ip_u || xIpu(q) > upbnd_Ip_u
                xIpu(q) = xIpu(q) - vIpu(q);
            end
        end
    end

        Tu = [];
        for i = 1:N;
            for j =1:N;
                T_u = 0.14*xTDSu(i)/(1*(((I_rele_u/xIpu(j))^0.02)-1));
                Tu = [Tu;T_u];
```

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```
    end
end
PbestTDSu = xTDSu;
PbestIpu = xIpu;
if bus ==1
    To = waktu_Rele_2 + 0.2;
elseif bus == 5
    To = waktu_R2 + 0.2;
elseif bus2 ==1
    To = waktu_Rele_2 + 0.2;
elseif bus4 ==1
    To = waktu_Rele_2 + 0.2;
elseif bus5 ==1
    To = waktu_Rele_2 + 0.2;
end
a = abs(To - Tu);
[nilaimin,posisimin]=min(a);
for i = 1:N*N
    if a(i,:) == 0
        posisimin = i;
        break
        GbestTDSu = PbestTDSu(fix((posisimin-1)/N)+1);
        GbestIpu = PbestIpu(posisimin-(fix((posisimin-1)/N))*N);
```

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```
            end
        end
        GbestTDSu = PbestTDSu(fix((posisimin-1)/N)+1);
        GbestIpu = PbestIpu(posisimin-(fix((posisimin-1)/N))*N);
        waktu_Ru = Tu(posisimin);
        tap_h_Ru = (fix(((0.8 * Iscmin_Ru)/CT_Ru)*10-0.001))/10;
        if tap_h_Ru > 15
            tap_h_Ru = 15;
        end

else
    waktu_Ru = 0;
    GbestTDSu = 0;
    GbestIpu = 0;
    tap_h_Ru = 0;
end
setting_TDS_u = GbestTDSu;
setting_Ip_u = GbestIpu;
Tap_u = setting_Ip_u/CT_Ru;
waktu_Rele_u= waktu_Ru;
```

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```
    bataseror = 10^(-5);
    waktu_total = waktu_Rele_1 + waktu_Rele_2 + waktu_Rele_u;
    sumbu_x = [sumbu_x ; it];
    sumbu_y = [sumbu_y ; waktu_total];
    plot(sumbu_x,sumbu_y,'red')
    hold on
    title('Grafik Konvergensi PSO')
    xlabel('iterasi')
    ylabel('Fitness')
end

rele = ['1' , '2' , 'utility'];
waktu_Rele = [ waktu_Rele_1 waktu_Rele_2 waktu_Rele_u] ;
setting_TDS = [ setting_TDS1 setting_TDS2 setting_TDS_u];
setting_Ip = [ setting_Ip1 setting_Ip2 setting_Ip_u] ;
Tap = [Tap_1 Tap_2 Tap_u];
tap_h = [tap_h_R1 tap_h_R2 tap_h_Ru];

disp('======================================================
=============================================');
disp('                                            HASIL                       ');
```

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```
disp('==========================================================
=================================================');
disp('          | Rele    |   TDS     |       Ip      |     Tap     |  TIME DELAY  |   Tap
highset  |   '         );
disp('------------------------------------------------------------------------------------------
-------');
for m = 1:3


    fprintf('  %13.3g', m);
    fprintf('  %13.4f', setting_TDS(m));
    fprintf('  %13.4f', setting_Ip(m));
    fprintf('  %13.4f', Tap(m));
    fprintf('  %10.3f', waktu_Rele(m));
    fprintf('  %13.4f', tap_h(m));
    fprintf('\n');
end
disp('rele 3 = rele utility')


% plot(sumbu_x,sumbu_y)
% title('Grafik Konvergensi PSO')
%     xlabel('iterasi')
%     ylabel('Fitness')
```

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```
% setting highset
% IsetH_R1 =(round((rand(N,dim)*(0.8*Iscmin_R1-1.6*FLA_R1) +
1.6*FLA_R1)/10)*10);
% lwbnd_Ip_1 = (round((1.6*FLA_R1)/10))*10
% upbnd_Ip_1 = (round((0.8*Iscmin_R1)/10))*10
%
% IsetH_R2 =(round((rand(N,dim)*(0.8*Iscmin_R2-1.6*FLA_R2) +
1.6*FLA_R2)/10)*10);
% lwbnd_Ip_2 = (round((1.6*FLA_R2)/10))*10
% upbnd_Ip_2 = (round((0.8*Iscmin_R2)/10))*10
%
% IsetH_Ru =(round((rand(N,dim)*(0.8*Iscmin_Ru-1.6*FLA_Ru) +
1.6*FLA_Ru)/10)*10);
% lwbnd_Ip_u = (round((1.6*FLA_Ru)/10))*10
% upbnd_Ip_u = (round((0.8*Iscmin_Ru)/10))*10
toc
%%
```

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