```matlab
clear;clc;close all;

%####
    population=100;%####
    lower_bound=-1;%######
    upper_bound=2;
    code_length=9;%########
    code_rate=100;%#######
    iteration=1000;%####
    select_rate=0.5;%######
    crossover_rate=0.7;%####
    variation_rate=0.001;%####
    max_fitness = zeros(1,iteration);%##########
    max_fitness_x1 = zeros(1,iteration);%#######x1###
    max_fitness_x2 = zeros(1,iteration);%#######x2###
%######
    pop1=[];%x1###
    pop2=[];%x2###
    for i=1:population
        pop1(:,i)=lower_bound+(upper_bound-lower_bound)*rand;%####
#-1#2####x1
        pop2(:,i)=lower_bound+(upper_bound-lower_bound)*rand;%####
#-1#2####x2
    end


%######
    for time=1:iteration
    %##########
        fitness=zeros(1,population);%########
        fitness_value=zeros(1,population);%#########
        for i=1:population
            fitness(:,i)=1/(4-
(pop1(i)*sin(3*pop1(i))+pop2(i)*sin(3*pop2(i))));%#########

 fitness_value(:,i)=pop1(i)*sin(3*pop1(i))+pop2(i)*sin(3*pop2(i));
        end
        [max_fitness(:,time),max_position]=max(fitness_value);%#######
########
         max_fitness_x1(:,time)=pop1(:,max_position);%##########x1##
         max_fitness_x2(:,time)=pop2(:,max_position);%##########x2##
    %#####/##########
        sum_fitness=sum(fitness(:));%##########
        acc_p=cumsum(fitness/sum_fitness);%##########
        %fitness_aftersort=sort(fitness,'descend');%###########50#
        %#######
        for n=1:round(select_rate*size(pop1,2))
            matrix=find(acc_p>rand); %############
            if isempty(matrix)
                %n=n-1;
                continue
            end
```

```matlab
                parent_pop1(:,n)=pop1(:,matrix(1));%####################
##
        end
         for n=1:round(select_rate*size(pop2,2))
            matrix=find(acc_p>rand); %#############
            if isempty(matrix)
                %n=n-1;
                continue
            end
            parent_pop2(:,n)=pop2(:,matrix(1));%####################
##
        end
        pop1=parent_pop1;
        pop2=parent_pop2;
         %######
%
 smallest_fitness=fitness_aftersort(population*select_rate);%###50####
#fitness
%           for i=1:population%##pop#####"#50#####fitness"###
%               if fitness(i)<smallest_fitness
%                   pop1(i)=10;
%                   pop2(i)=10;
%               end
%           end
%           pop1(find(pop1==10))=[];%pop1#####
%           pop2(find(pop2==10))=[];%pop2#####

    %########
        pop1_gene=zeros(1,population*select_rate);%#####1###########
        pop2_gene=zeros(1,population*select_rate);
        pop1_gene=round((pop1-lower_bound)*code_rate);%###############
#########
        pop2_gene=round((pop2-lower_bound)*code_rate);
        for i=1:population*select_rate%#######
            dec2binpop1{i}=dec2bin(pop1_gene(i));
            length_dec1=length(dec2binpop1{i});

            for j=1:code_length-length_dec1%##########
                dec2binpop1{i}=['0' dec2binpop1{i}];
            end

            dec2binpop2{i}=dec2bin(pop2_gene(i));
            length_dec2=length(dec2binpop2{i});

            for j=1:code_length-length_dec2%##########
                dec2binpop2{i}=['0' dec2binpop2{i}];
            end
        end
    %#####
        length1=length(dec2binpop1);%#########
        length2=length(dec2binpop2);
        for i=1:(population-length1)%#############
            rand1=rand*(population*select_rate);%#########"#"
            if rand1<1%###=0
```

```matlab
                rand1=rand1+1;
            end
            rand_father=round(rand1);
            rand2=rand*(population*select_rate);
            if rand2<1
                rand2=rand2+1;
            end
            rand_mother=round(rand2);
            father=dec2binpop1{rand_father};
            mother=dec2binpop1{rand_mother};
            cross_location = ceil((length(father)-1)*rand);%##########
            if rand<crossover_rate
                father(1,cross_location:end) =
mother(1,cross_location:end);%#############
                father_num=bin2dec(father);
                kid_pop1{i}=father;
                if father_num>=300%#############-1#2#
                    kid_pop1{i}='100101100';
                end
            else
                kid_pop1{i}=father;
            end
        end

        for i=1:(population-length2)%##################
            rand1=rand*(population*select_rate);
            if rand1<1
                rand1=rand1+1;
            end
            rand_father=round(rand1);
            rand2=rand*(population*select_rate);
            if rand2<1
                rand2=rand2+1;
            end
            rand_mother=round(rand2);
            father=dec2binpop2{rand_father};
            mother=dec2binpop2{rand_mother};
            cross_location = ceil((length(father)-1)*rand)+1;
            if rand<crossover_rate
                father(1,cross_location:end) =
mother(1,cross_location:end);
                father_num=bin2dec(father);
                kid_pop2{i}=father;
                if father_num>=300
                    kid_pop2{i}='100101100';
                end
            else
                kid_pop2{i}=father;
            end
        end

    %##
        for i=1:length(kid_pop1)
            if rand<variation_rate
```

```matlab
                temp=kid_pop1{i};
                location = ceil(length(temp)*rand);%###########
                temp = [temp(1:location-1)
    num2str(~str2double(temp(location)))...
                    temp(location+1:end)];
                kid_pop1{i}=temp;
            end
        end
        for i=1:length(kid_pop2)
            if rand<variation_rate
                temp=kid_pop2{i};
                location = ceil(length(temp)*rand);%###########
                temp = [temp(1:location-1)
    num2str(~str2double(temp(location)))...
                    temp(location+1:end)];
                kid_pop2{i}=temp;
            end
        end


    %####
        for i=1:length(kid_pop1)
            kid_pop1{i}=(bin2dec(kid_pop1{i})/100)+lower_bound;%######
####100######
        end
        for i=1:length(kid_pop2)
            kid_pop2{i}=(bin2dec(kid_pop2{i})/100)+lower_bound;%######
####100######
        end

    %#####
        for i=population*select_rate+1:population
            pop1(i)=kid_pop1{i-population*select_rate};
            pop2(i)=kid_pop2{i-population*select_rate};
        end


    end
    %#######
    figure;
    plot(max_fitness);
    title('####');
    [max_fitness_one,max_position]=max(max_fitness);%###############
    disp(['####' num2str(max_fitness_one)]);
    disp(['###x1#' num2str(max_fitness_x1(max_position))]);
    disp(['###x2#' num2str(max_fitness_x2(max_position))]);

####2.7058
###x1#2.54
###x2#0.3
```
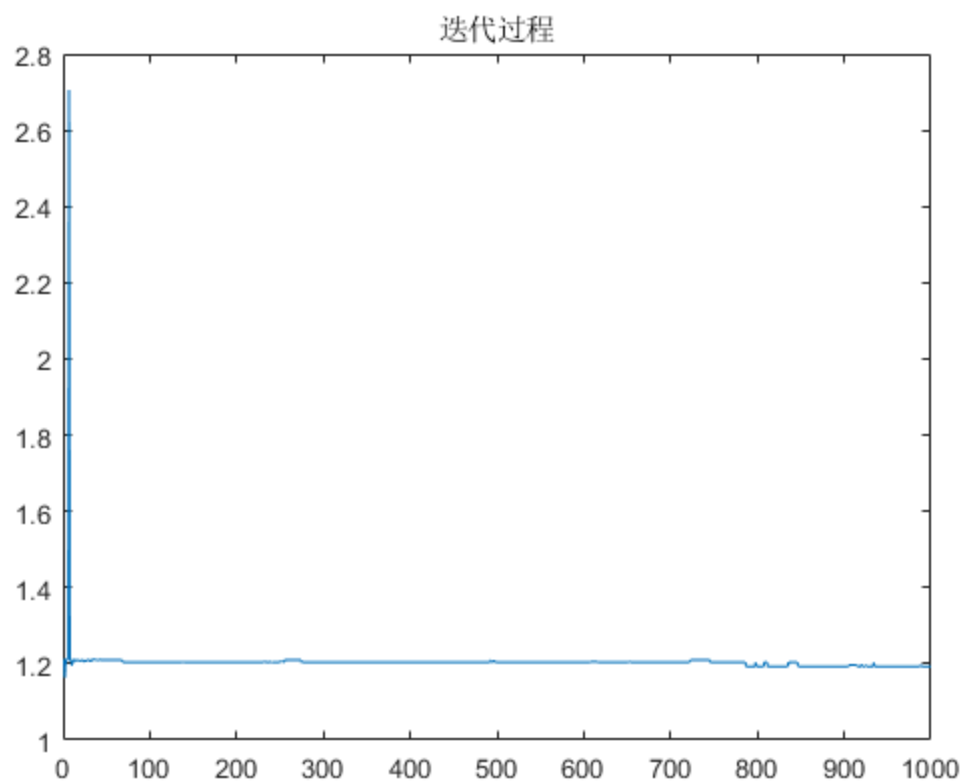
迭代过程

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