

Editor - C:\Users\revan\Desktop\THD_Formula.m

```

1 clear;
2 close all;
3 d=96/pi;
4 x=[6.5698 18.9402 27.1833 45.1358 62.2425];
5 v1=abs((sum(cosd(x))))*d;
6 v5=abs((sum(cosd(5*x))))*d/5;
7 v7=abs((sum(cosd(7*x))))*d/7;
8 v11=abs((sum(cosd(11*x))))*d/11;
9 v13=abs((sum(cosd(13*x))))*d/13;
10 v17=abs((sum(cosd(17*x))))*d/17;
11 v19=abs((sum(cosd(19*x))))*d/19;
12 v23=abs((sum(cosd(23*x))))*d/23;
13 v29=abs((sum(cosd(29*x))))*d/29;
14 v31=abs((sum(cosd(31*x))))*d/31;
15 v37=abs((sum(cosd(37*x))))*d/37;
16 v41=abs((sum(cosd(41*x))))*d/41;
17 v43=abs((sum(cosd(43*x))))*d/43;
18 v47=abs((sum(cosd(47*x))))*d/47;
19 v49=abs((sum(cosd(49*x))))*d/49;
20 v=sqrt(v5^2+v7^2+v11^2+v13^2+v17^2+v19^2+v23^2+v29^2+v31^2+v37^2+v41^2+v43^2+v47^2+v49^2);
21 thd=(v/v1)*100;
22 disp('THD');
23 disp(thd);
24 h5=sum(cosd(5*x));
25 h7=sum(cosd(7*x));
26 h11=sum(cosd(11*x));
27 h13=sum(cosd(13*x));
28

```

Command Window

```

Iteration 97: Best Cost = 5.7912e-06
Iteration 98: Best Cost = 5.7912e-06
Iteration 99: Best Cost = 5.7912e-06
Iteration 100: Best Cost = 5.7912e-06
>> b
b =
    Position: [6.5698 18.9402 27.1833 45.1358 62.2425]
    Cost: 5.7912e-06

>> THD_Formula
THD
    4.4693

5th harmonic
   -3.5162e-06
7th harmonic
    8.6708e-06
11th harmonic
    8.6897e-06
13th harmonic
    2.8172e-05
modulation index
    0.8000

```

outputs

Editor - C:\Users\revan\Desktop\GA_obj.m

```

1 function z=obj(x)
2
3 % Length(x);
4 m=0.8;
5
6 %for 5 level
7 if (s==2)
8
9     v5=abs((sum(cosd(5*x))))/5;
10
11 % sorting
12 if (x(1) >= x(2))
13     v5 = v5 + 999;
14
15 end
16
17 v=v5;
18
19 z=100*(abs(m-(abs(sum(cosd(x))))/2)+v/2);
20
21 %%
22 %for 7 level
23 if (s==3)
24
25     v5=abs((sum(cosd(5*x))))/5;
26     v7=abs((sum(cosd(7*x))))/7;
27
28 %sorting
29 if (x(1) >= x(2)) || (x(1) >= x(3))

```

Command Window

```

Iteration 97: Best Cost = 5.7912e-06
Iteration 98: Best Cost = 5.7912e-06
Iteration 99: Best Cost = 5.7912e-06
Iteration 100: Best Cost = 5.7912e-06
>> b
b =
    Position: [6.5698 18.9402 27.1833 45.1358 62.2425]
    Cost: 5.7912e-06

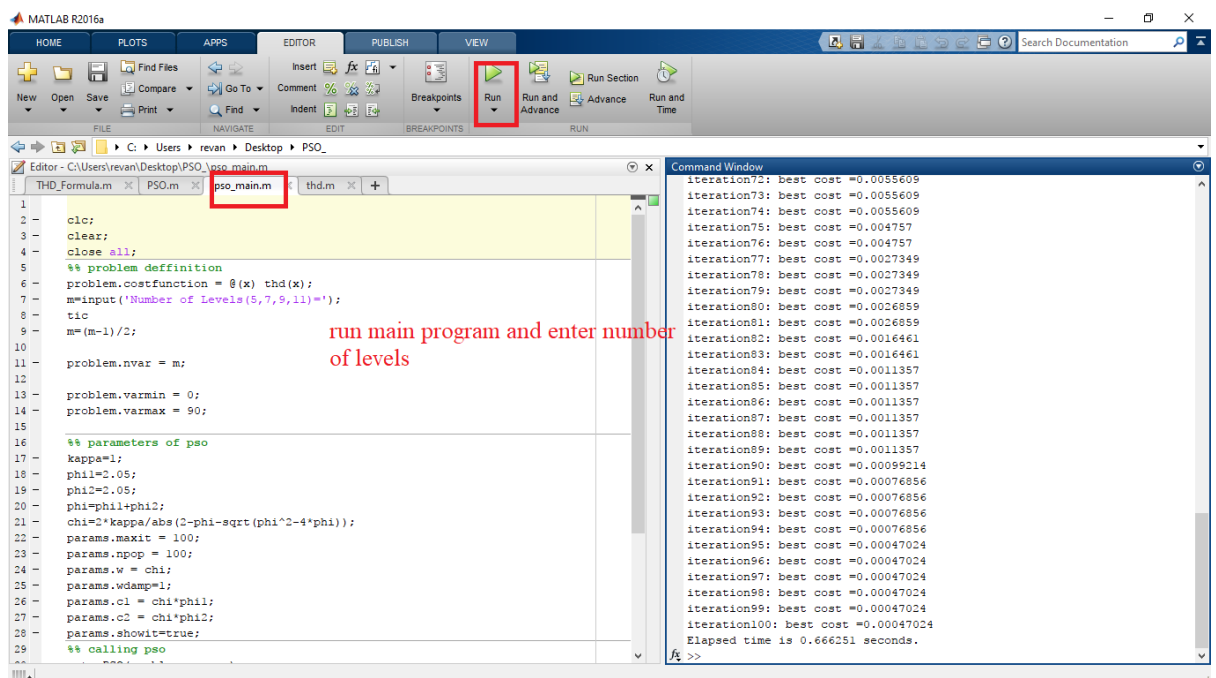
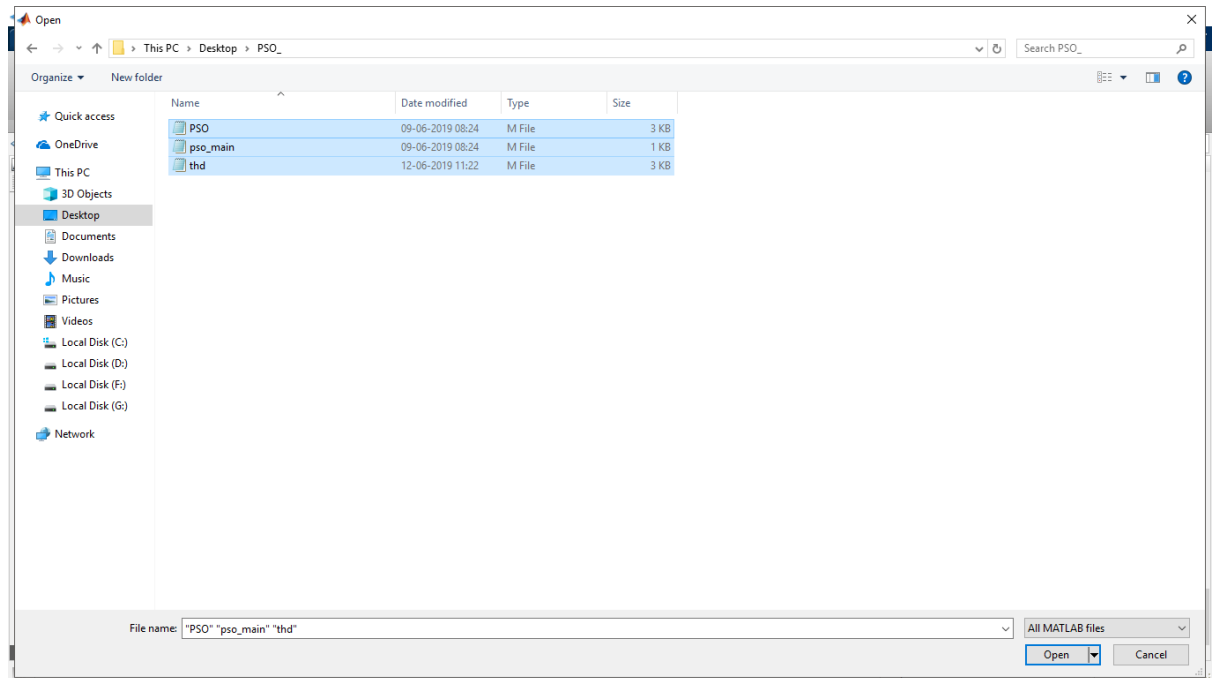
>> THD_Formula
THD
    4.4693

5th harmonic
   -3.5162e-06
7th harmonic
    8.6708e-06
11th harmonic
    8.6897e-06
13th harmonic
    2.8172e-05
modulation index
    0.8000

```

**change the value of m to
change modulation index value
and again run main program**

For pso close all programs keep only thd formula and open pso folder same as ga and select all programs and open



MATLAB R2016a

HOME PLOTS APPS EDITOR PUBLISH VIEW

Find Files Find Go To Comment % Indent Breakpoints Run Run and Advance Run Section Run and Time

FILE NAVIGATE EDIT BREAKPOINTS RUN

Editor - C:\Users\revan\Desktop\PSO\psd_main.m

```

1  THD_Formula.m x PSD.m x psd_main.m x thd.m x +
2  clear;
3  close all;
4  % problem definition
5  problem.costfunction = @(x) thd(x);
6  m=input('Number of Levels(5,7,9,11)=');
7  tic
8  m=(m-1)/2;
9
10
11  problem.nvar = m;
12
13  problem.varmin = 0;
14  problem.varmax = 90;
15
16  %% parameters of psd
17  kappa=1;
18  phi1=2.05;
19  phi2=2.05;
20  phi=phi1+phi2;
21  chi=2*kappa/abs(2-phi-sqrt(phi^2-4*phi));
22  params.maxit = 100;
23  params.npop = 100;
24  params.w = chi;
25  params.wdamp=1;
26  params.c1 = chi*phi1;
27  params.c2 = chi*phi2;
28  params.showIt=true;
29  %% calling psd

```

enter b to get output value and copy those and paste in thd formula

Command Window

```

iteration79: best cost =0.0027349
iteration80: best cost =0.0026859
iteration81: best cost =0.0026859
iteration82: best cost =0.0016461
iteration83: best cost =0.0016461
iteration84: best cost =0.0011357
iteration85: best cost =0.0011357
iteration86: best cost =0.0011357
iteration87: best cost =0.0011357
iteration88: best cost =0.0011357
iteration89: best cost =0.0011357
iteration90: best cost =0.0009214
iteration91: best cost =0.0007686
iteration92: best cost =0.0007686
iteration93: best cost =0.0007686
iteration94: best cost =0.0007686
iteration95: best cost =0.00047024
iteration96: best cost =0.00047024
iteration97: best cost =0.00047024
iteration98: best cost =0.00047024
iteration99: best cost =0.00047024
iteration100: best cost =0.00047024
Elapsed time is 0.666251 seconds.
>> b
b =
position: 6.5698 18.9407 27.1829 45.1358 62.2425
cost: 4.7024e-04
>>

```

MATLAB R2016a

HOME PLOTS APPS EDITOR PUBLISH VIEW

Find Files Find Go To Comment % Indent Breakpoints Run Run and Advance Run Section Run and Time

FILE NAVIGATE EDIT BREAKPOINTS RUN

Editor - C:\Users\revan\Desktop\THD_Formula.m

```

1  THD_Formula.m x PSD.m x psd_main.m x thd.m x +
2  clear;
3  close all;
4  d=96/pi;
5  x=[6.5698 18.9407 27.1829 45.1358 62.2425];
6  v1=abs((sum(cosd(x))))/d;
7  v5=abs((sum(cosd(5*x))))*d/5;
8  v7=abs((sum(cosd(7*x))))*d/7;
9  v11=abs((sum(cosd(11*x))))*d/11;
10 v13=abs((sum(cosd(13*x))))*d/13;
11 v17=abs((sum(cosd(17*x))))*d/17;
12 v19=abs((sum(cosd(19*x))))*d/19;
13 v23=abs((sum(cosd(23*x))))*d/23;
14 v29=abs((sum(cosd(29*x))))*d/29;
15 v31=abs((sum(cosd(31*x))))*d/31;
16 v37=abs((sum(cosd(37*x))))*d/37;
17 v41=abs((sum(cosd(41*x))))*d/41;
18 v43=abs((sum(cosd(43*x))))*d/43;
19 v47=abs((sum(cosd(47*x))))*d/47;
20 v49=abs((sum(cosd(49*x))))*d/49;
21 v=sqrt(v5^2+v7^2+v11^2+v13^2+v17^2+v19^2+v23^2+v29^2+v31^2+v37^2+v41^2+v43^2+v47^2+v49^2);
22 thd=(v/v1)*100;
23 disp('THD');
24 disp(thd);
25 h5=sum(cosd(5*x));
26 h7=sum(cosd(7*x));
27 h11=sum(cosd(11*x));
28 h13=sum(cosd(13*x));
29 h=sqrt(h5^2+h7^2+h11^2+h13^2);
30 modindex=(h/h1)*100;

```

Command Window

```

iteration98: best cost =0.00047024
iteration99: best cost =0.00047024
iteration100: best cost =0.00047024
Elapsed time is 0.666251 seconds.
>> b
b =
position: 6.5698 18.9407 27.1829 45.1358 62.2425
cost: 4.7024e-04
>> THD_Formula
THD
4.4691
5th harmonic
-2.2717e-05
7th harmonic
-4.5030e-05
11th harmonic
-1.2892e-05
13th harmonic
1.2153e-04
modulation index
0.8000
>>

```

script Ln 5 Col 42

MATLAB R2016a

Editor - C:\Users\revan\Desktop\PSO_thd.m

```
1 function z = thd(x)
2
3 s=length(x);
4 m=0.8;
5
6 %for 5 level
7 if (s==2)
8
9 v5=abs((sum(cosd(5*x)))/5);
10 % sorting
11 if (x(1) >= x(2))
12 v5 = v5 + 999;
13
14 end
15
16 v=v5;
17
18 z=100*(abs(m-(abs(sum(cosd(x)))/2)+v/2);
19
20 %%
21 %for 7 level
22 if (s==3)
23
24 v5=abs((sum(cosd(5*x)))/5);
25 v7=abs((sum(cosd(7*x)))/7);
26
27 %sorting
28 if (x(1) >= x(2)) || (x(1) >= x(3))
29 v5 = v5 + 999;
30 v7 = v7 + 999;
```

to change modulation index goto thd and change m value and run the main programme

Command Window

```
iteration98: best cost =0.00047024
iteration99: best cost =0.00047024
iteration100: best cost =0.00047024
Elapsed time is 0.666251 seconds.
>> b

b =

    position: [6.5698 18.9407 27.1829 45.1358 62.2425]
    cost: 4.7024e-04

>> THD_Formula
THD
    4.4691

5th harmonic
    -2.2717e-05

7th harmonic
    -4.5030e-05

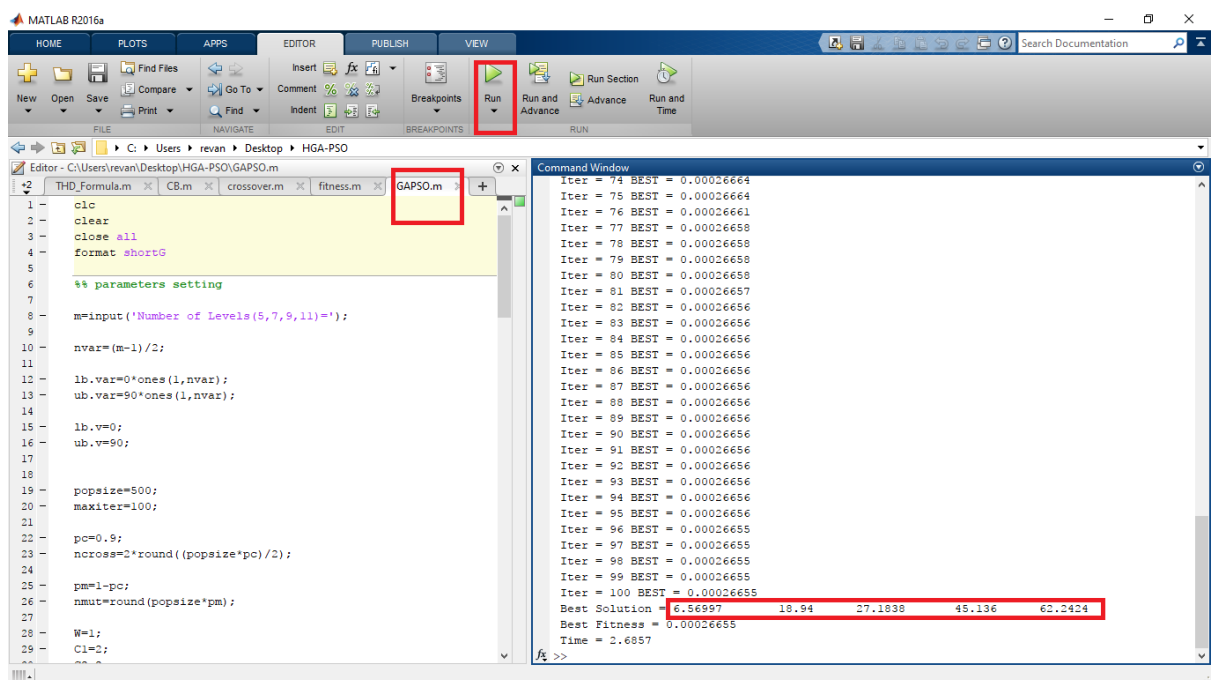
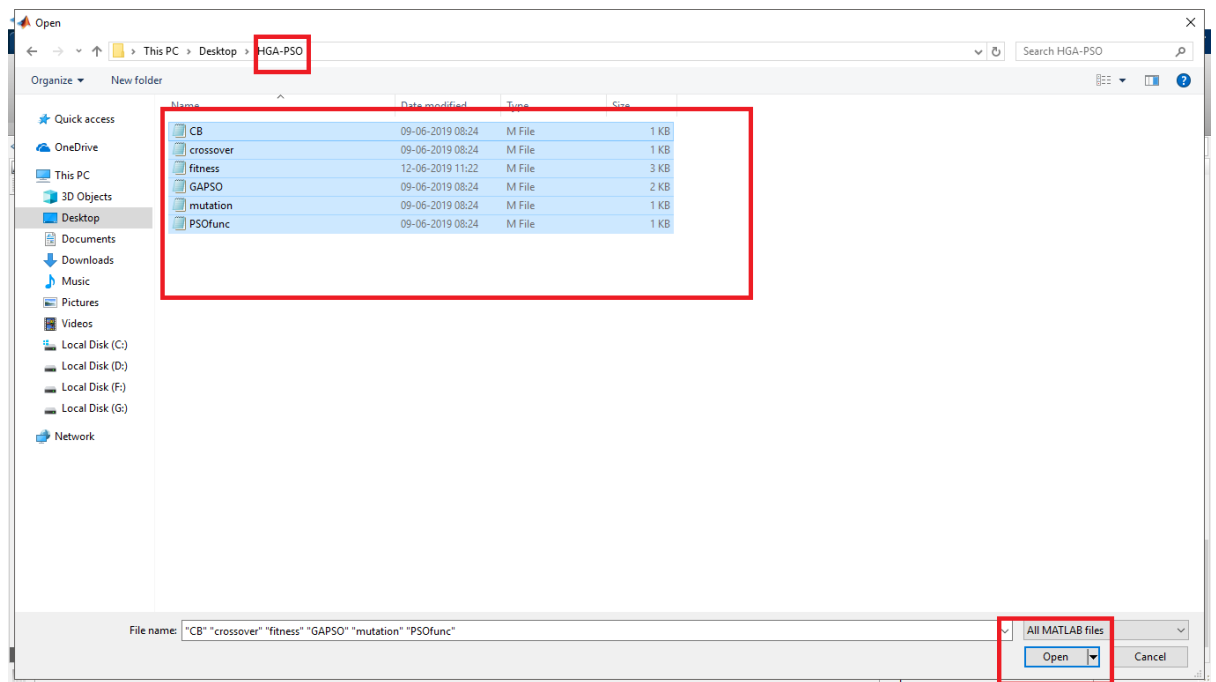
11th harmonic
    -1.2892e-05

13th harmonic
    1.2153e-04

modulation index
    0.8000

f>>
```

To open hgapsso close all the programs and keep only thd formula and open hgapsso and select all and open



Copy those values and paste it in thd formula and again run.

The screenshot shows the MATLAB R2016a interface. The Editor window displays the script `THD_Formula.m`. The Command Window shows the execution results, including the best solution and various harmonic values.

```

clear;
close all;
d=6.65;
x=[6.56997 18.94 27.1838 45.136 62.2424];
v1=abs((sum(cosd(x))))*d;
v5=abs((sum(cosd(5*x))))*d/5;
v7=abs((sum(cosd(7*x))))*d/7;
v11=abs((sum(cosd(11*x))))*d/11;
v13=abs((sum(cosd(13*x))))*d/13;
v17=abs((sum(cosd(17*x))))*d/17;
v19=abs((sum(cosd(19*x))))*d/19;
v23=abs((sum(cosd(23*x))))*d/23;
v29=abs((sum(cosd(29*x))))*d/29;
v31=abs((sum(cosd(31*x))))*d/31;
v37=abs((sum(cosd(37*x))))*d/37;
v41=abs((sum(cosd(41*x))))*d/41;
v43=abs((sum(cosd(43*x))))*d/43;
v47=abs((sum(cosd(47*x))))*d/47;
v49=abs((sum(cosd(49*x))))*d/49;
v=sqrt(v5^2+v7^2+v11^2+v13^2+v17^2+v19^2+v23^2+v29^2+v31^2+v37^2+v41^2+v43^2+v47^2+v49^2);
thd=(v/v1)*100;
disp('THD');
disp(thd);
h5=sum(cosd(5*x));
h7=sum(cosd(7*x));
h11=sum(cosd(11*x));
h13=sum(cosd(13*x));
modulation_index=(h5+h7+h11+h13)/v1;

```

Command Window Output:

```

Iter = 93 BEST = 0.00026656
Iter = 94 BEST = 0.00026656
Iter = 95 BEST = 0.00026656
Iter = 96 BEST = 0.00026655
Iter = 97 BEST = 0.00026655
Iter = 98 BEST = 0.00026655
Iter = 99 BEST = 0.00026655
Iter = 100 BEST = 0.00026655
Best Solution = 6.56997 18.94 27.1838 45.136 62.2424
Best Fitness = 0.00026655
Time = 2.6857
>> THD_Formula
THD
4.4692
5th harmonic
-1.8602e-05
7th harmonic
5.1459e-05
11th harmonic
5.78e-06
13th harmonic
1.7012e-05
modulation index
0.8

```

The screenshot shows the MATLAB R2016a interface. The Editor window displays the script `fitness.m`. The Command Window shows the execution results, including the best solution and various harmonic values.

```

function Z=fitness(x)
s=length(x);
m=0.8;
%%
%for 5 level
if (s==2)
v5=abs((sum(cosd(5*x))))/5;
% sorting
if (x(1) >= x(2))
v5 = v5 + 999;
end
v=v5;
Z=100*(abs(m- (abs(sum(cosd(x))))/2)+v/2);
end
%%
%for 7 level
if (s==3)
v5=abs((sum(cosd(5*x))))/5;
v7=abs((sum(cosd(7*x))))/7;
%sorting
if (x(1) >= x(2)) || (x(1) >= x(3))
v5 = v5 + 999;
v7 = v7 + 999;
end
end

```

Command Window Output:

```

Iter = 93 BEST = 0.00026656
Iter = 94 BEST = 0.00026656
Iter = 95 BEST = 0.00026656
Iter = 96 BEST = 0.00026655
Iter = 97 BEST = 0.00026655
Iter = 98 BEST = 0.00026655
Iter = 99 BEST = 0.00026655
Iter = 100 BEST = 0.00026655
Best Solution = 6.56997 18.94 27.1838 45.136 62.2424
Best Fitness = 0.00026655
Time = 2.6857
>> THD_Formula
THD
4.4692
5th harmonic
-1.8602e-05
7th harmonic
5.1459e-05
11th harmonic
5.78e-06
13th harmonic
1.7012e-05
modulation index
0.8

```

To change modulation index goto fitness change m value and run gapso programe