

(1) Particle Swarm Optimization:

A. 2 Dimension:

參數 ./main 30 2 30
30 particals(population)
2 dimension
30 run
20000 evaluation

```
allen@DESKTOP-TKIN1M5:/mnt/c/Users/User/Desktop/Lab/Week3$ ./main 30 2 30
```

```
nfes: 19950, Best Value: 4.44089e-16, Best Position: -2.97437e-17 -6.2669e-17  
nfes: 19980, Best Value: 4.44089e-16, Best Position: -2.97437e-17 -6.2669e-17  
nfes: 20010, Best Value: 4.44089e-16, Best Position: -2.97437e-17 -6.2669e-17
```

B. 10 Dimension:

參數 ./main 60 10 30
60 particals(population)
10 dimension
30 run
100000 evaluation

```
allen@DESKTOP-TKIN1M5:/mnt/c/Users/User/Desktop/Lab/Week3$ ./main 60 10 30
```

```
nfes: 99900, Best Value: 3.9968e-15, Best Position: 7.19678e-16 6.59923e-16 4.13692e-16 -4.24075e-16 1.03761e-15 -2.3401e-15 1.46518e-16 -1.32415e-15 7.71507e-16 -2.29824e-15  
nfes: 99960, Best Value: 3.9968e-15, Best Position: 7.19678e-16 6.59923e-16 4.13692e-16 -4.24075e-16 1.03761e-15 -2.3401e-15 1.46518e-16 -1.32415e-15 7.71507e-16 -2.29824e-15  
nfes: 100020, Best Value: 3.9968e-15, Best Position: 7.19678e-16 6.59923e-16 4.13692e-16 -4.24075e-16 1.03761e-15 -2.3401e-15 1.46518e-16 -1.32415e-15 7.71507e-16 -2.29824e-15
```

➤ 共同參數：

$\omega_{\max} = 0.9$, $\omega_{\min} = 0.4$; // 動態遞減慣性權重
 $\text{toward_pBest} = 1.5$, $\text{toward_gBest} = 1.5$; // 個體加速因子和社會加速因子

➤ 邊界：

-32765~32768

➤ Ackley Function：

```
➤ const double a = 20.0;  
➤ const double b = 0.2;  
➤ const double c = 2 * M_PI;
```

(2) Differential Evolution:

A. 2 Dimension:

參數 ./main 30 2 1

30 particals(population)

2 dimension

1 run

20000 evaluation

```
allen@DESKTOP-TKIN1M5:/mnt/c/Users/User/Desktop/Lab/Week3/Differential Evolution$ ./main 30 2 1
```

```
nfes: 19950, Best Value: 4.44089e-16, Best Position: 1.66687e-16 -3.34107e-17
nfes: 19980, Best Value: 4.44089e-16, Best Position: 1.66687e-16 -3.34107e-17
nfes: 20010, Best Value: 4.44089e-16, Best Position: 1.66687e-16 -3.34107e-17
```

B. 10 Dimension:

參數 ./main 60 10 1

60 particals(population)

10 dimension

1 run

100000 evaluation

```
allen@DESKTOP-TKIN1M5:/mnt/c/Users/User/Desktop/Lab/Week3/Differential Evolution$ ./main 60 10 1
```

```
nfes: 99900, Best Value: 3.9968e-15, Best Position: 5.08058e-16 1.58004e-15 7.68303e-16 2.75332e-15 4.76402e-16 2.00319e-16 -1.11759e-15 -3.06608e-16 1.55211e-15 8.57169e-16
nfes: 99960, Best Value: 3.9968e-15, Best Position: 5.08058e-16 1.58004e-15 7.68303e-16 2.75332e-15 4.76402e-16 2.00319e-16 -1.11759e-15 -3.06608e-16 1.55211e-15 8.57169e-16
nfes: 100020, Best Value: 3.9968e-15, Best Position: 5.08058e-16 1.58004e-15 7.68303e-16 2.75332e-15 4.76402e-16 2.00319e-16 -1.11759e-15 -3.06608e-16 1.55211e-15 8.57169e-16
```

➤ 共同參數：

double F = 0.5; // 擴張係數

double CR = 0.9; // 交叉率

➤ 邊界：

-32765~32768

➤ Ackley Function：

```
➤ const double a = 20.0;
➤ const double b = 0.2;
➤ const double c = 2 * M_PI;
```