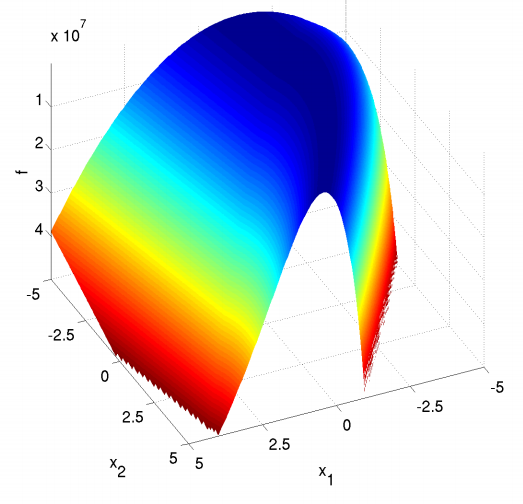
**Definitions of the Basic Functions**

**1) Bent Cigar Function**

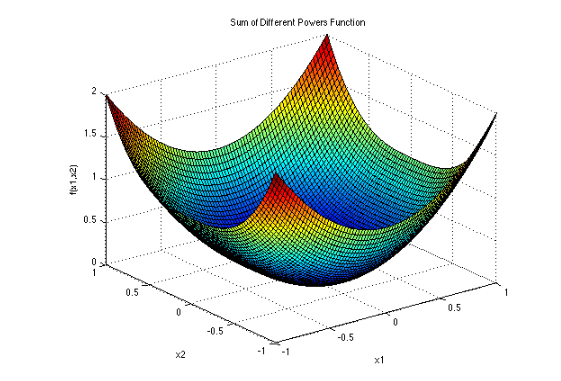
****

****

**单峰 边界： 最优值0**

**2) Sum of Different Power Function**

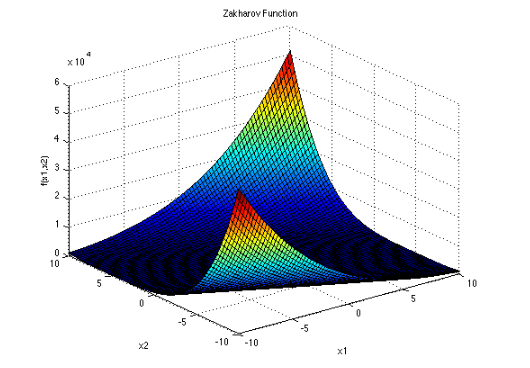
****

****

**单峰，对称 界限：[-100,100]d 最优值：0**

**3) Zakharov Function**

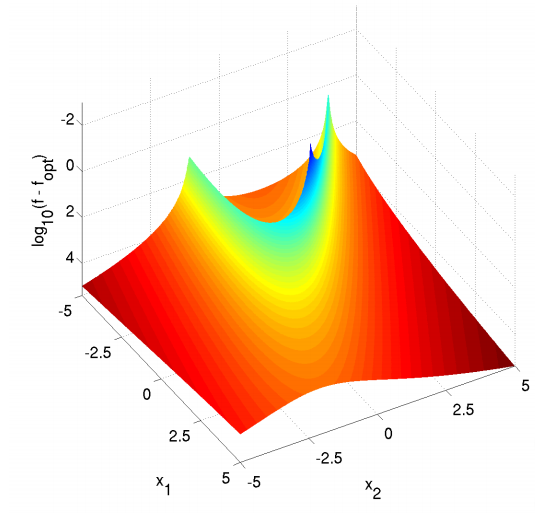
****

****

**单峰 边界：，最优值：0**

**4) Rosenbrock’s Function**

****

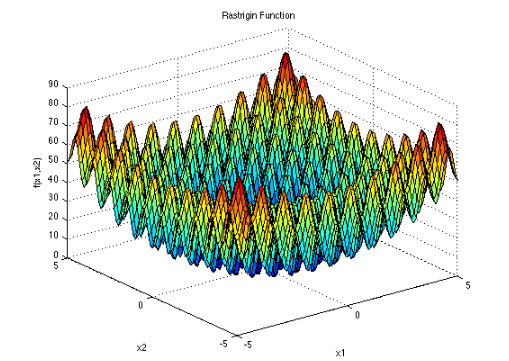
****

**最优解为0，分布在X=[1,1,1,…1]处。界限：**

**多峰，有最大局部极值**

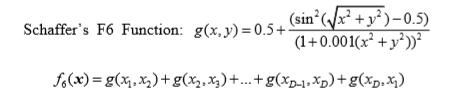
**5) Rastrigin’s Function**

****

****

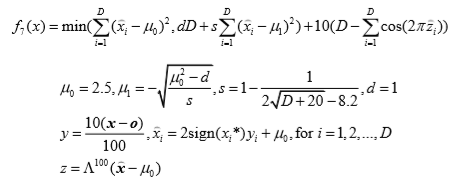
**多峰，****局部最优值较大，次优值与全局最优值相差很大。 界限：，最优值0**

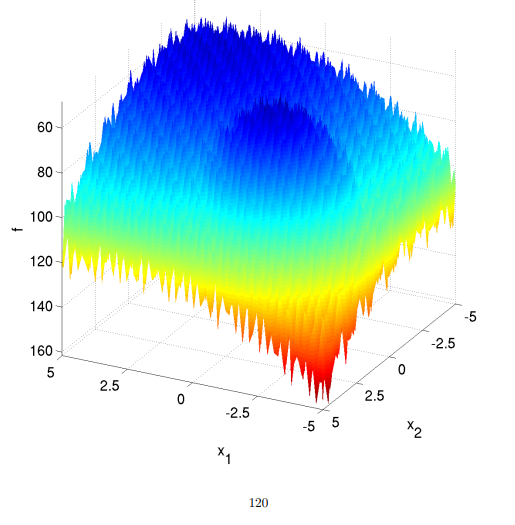
**6) Expanded Schaffer’s F6 Function**

****

**多峰**

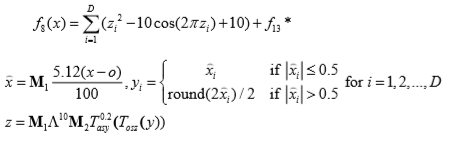
**7) Lunacek bi-Rastrigin Function**

****

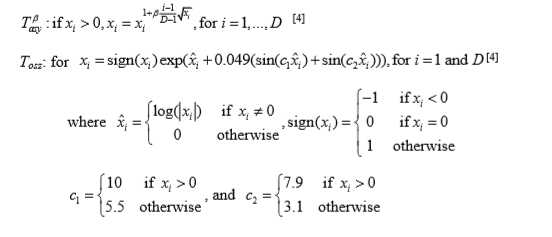
****

**多峰，处处连续，处处可微 边界[-5,5]d**

**8) Non-continuous Rotated Rastrigin’s Function**

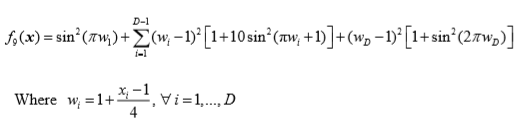
****

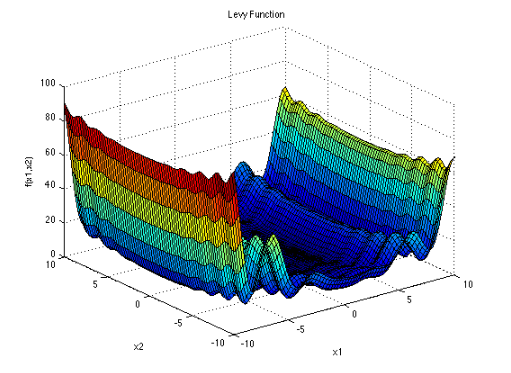
**Where ：a diagonal matrix in D dimensions with the *i*th diagonal element as , *i*=1,2,…,*D*.**

****

**多峰**

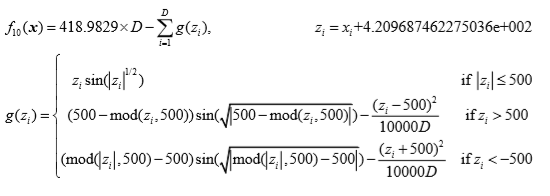
**9) Levy Function**

****

****

**多峰 界限：[-10,10]d，最优值：0，坐标：*x*\*=(1,…,1)**

**10) Modified Schwefel’s Function**

****

**多峰，有很多局部最优值，次优值与全局最优值相差很大**

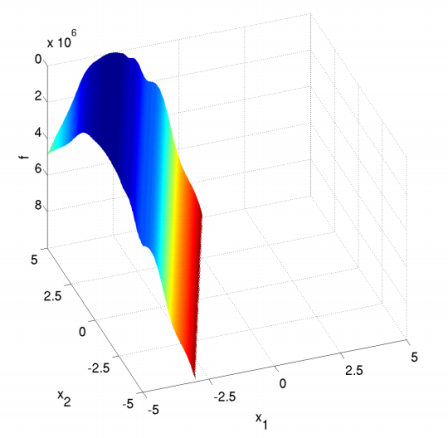
**11) High Conditioned Elliptic Function**

****

**单峰**

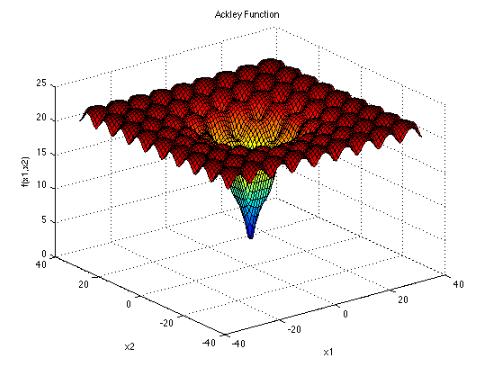
**12)** **Discus Function**

****

**  
多维单峰函数**

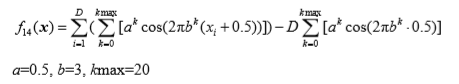
**13) Ackley’s Function**

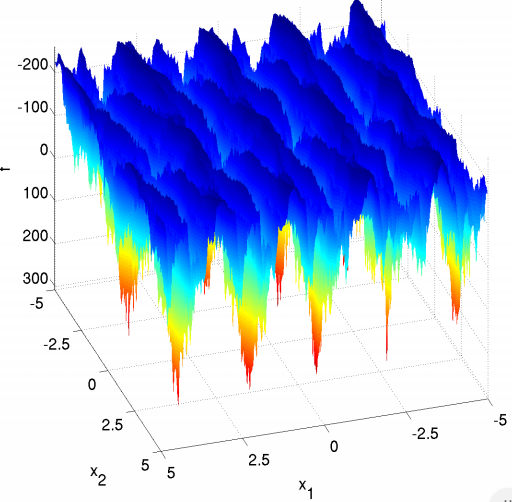
****

****

**多峰 界限：，最优值：0，坐标：(0,…,0)**

**14) Weierstrass Function**

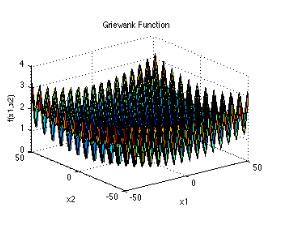
****

****

**多峰，连续但仅在一组点上可微**

**15) Griewank’s Function**

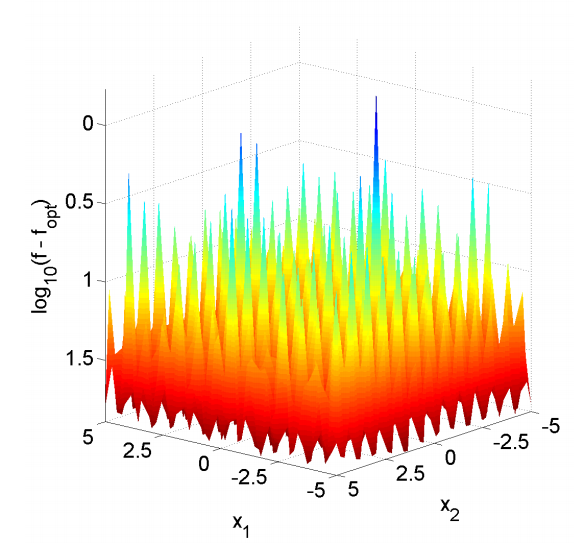
****

****

**多峰，边界，最优值0，坐标：(0,…,0)**

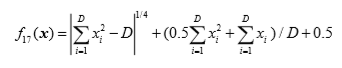
**16) Katsuura Function**

****

****

**多峰**

**17) HappyCat Function**

****

**多峰**

**18) HGBat Function**

****

**多峰**

**19) Expanded Griewank’s plus Rosenbrock’s Function**

****

**多峰**

**20) Schaffer's F7 Function**

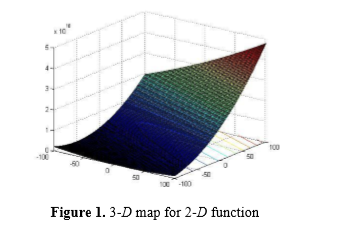
****

**多峰，有大量局部极值**

**Summary of the CEC’17 Test Functions**

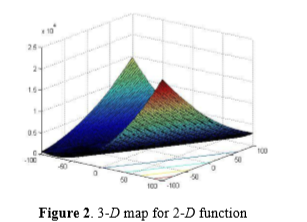
1. **Unimodal Functions**
2. **Shifted and Rotated Bent Cigar**

****

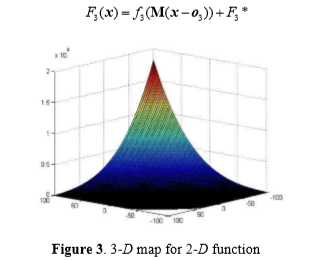
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**2）Shifted and Rotated Sum of Different Power Function**

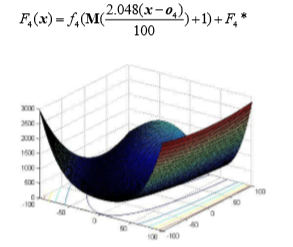
****

****

**3）Shifted and Rotated Zakharov Function**

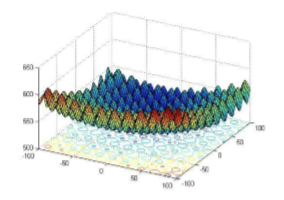
****

**4）Shifted and Rotated Rosenbrock’s Function**

****

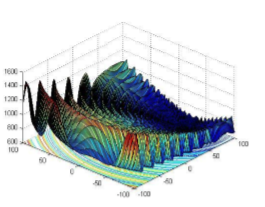
**5）Shifted and Rotated Rastrigin’s Function**

****

****

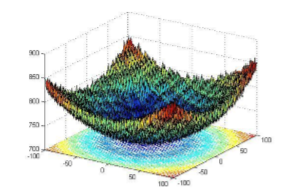
**6）Shifted and Rotated Schaffer’s F7 Function**

****

****

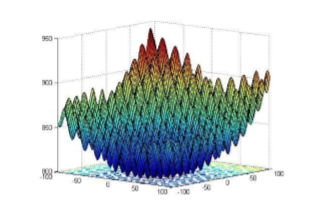
**7）Shifted and Rotated Lunacek Bi-Rastrigin’s Function**

****

****

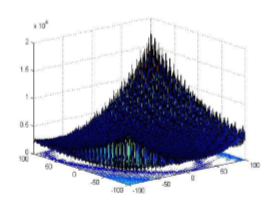
**8）Shifted and Rotated Non-Continuous Rastrigin’s Function**

****

****

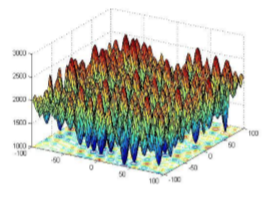
**9）Shifted and Rotated Levy Function**

****

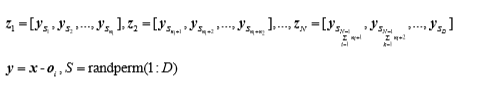
****

**10）Shifted and Rotated Schwefel’s Function**

****

****

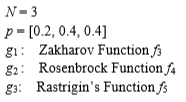
**混合函数**

****

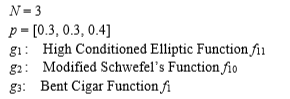
***N*:基本函数的数量**

***P*:用于控制*gi*(*x*)所占的比例，**

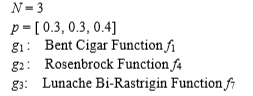
**11）Hybrid Function 1**

****

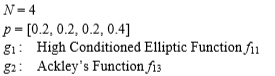
**12）Hybrid Function 2**

****

**13）Hybrid Function 3**

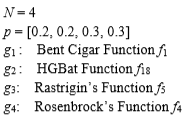
****

**14）Hybrid Function 4**

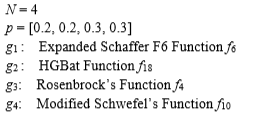
****

****

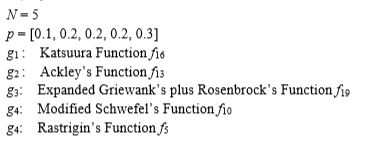
**15）Hybrid Function 5**

****

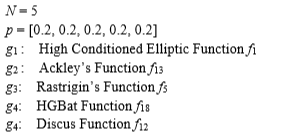
**16）Hybrid Function 6**

****

**17）Hybrid Function 7**

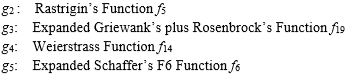
****

**18）Hybrid Function 8**

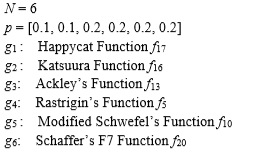
****

**19）Hybrid Function 9**

****

****

**20）Hybrid Function 10**

****

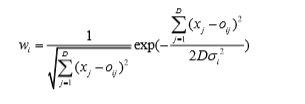
**符合函数**

****

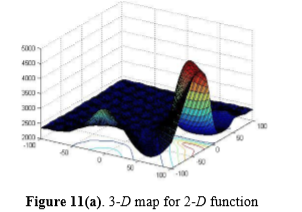
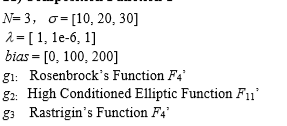
***oi*:每个函数新的最优移动位置，定义了全局和局部最优位置**

***bisasi：*定义全局最优值**

**:控制所选函数的覆盖范围**

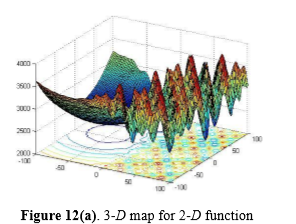
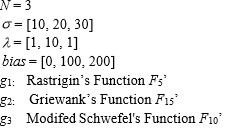
****

**21）Composition Function 1**

****

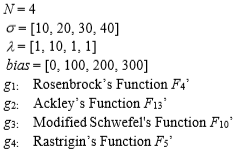
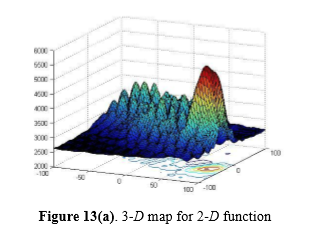
**多模**

**22）Composition Function 2**

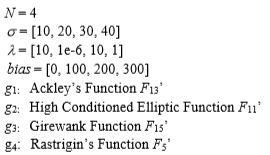
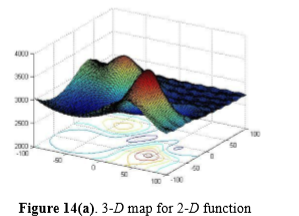
****

**多模**

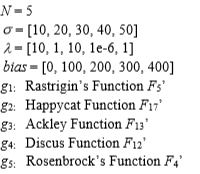
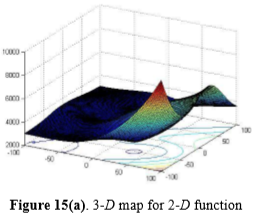
**23）Composition Function 3**

** **

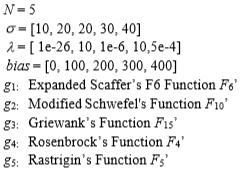
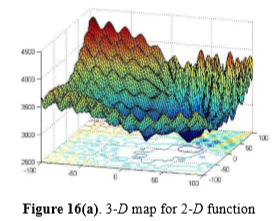
**24）Composition Function 4**

** **

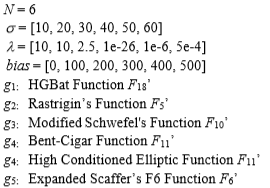
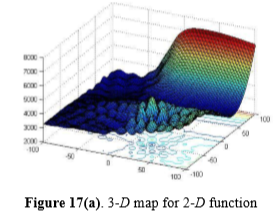
**25）Composition Function 5**

** **

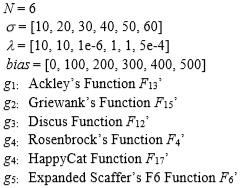
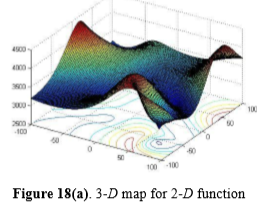
**26）Composition Function 6**

** **

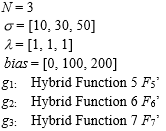
**27）Composition Function 7**

** **

**28）Composition Function 8**

** **

29）Composition Function 10



30）Composition Function 10

