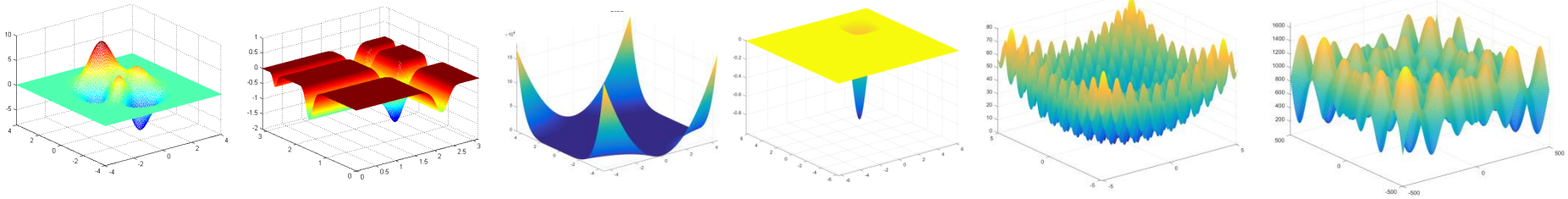
章节目的

算法性能如何分析？如何比较？

通过多种测试图形进行最小值/最大值搜寻



章节课题

- 绘制 3D 图形与等高线图指令说明。
- 举例 6 个典型测试多峰图形与特性。

章节作业

- 试绘制 6 个典型测试多峰图形的 3D 图与等高线图。
- 试着将粒子算法套入 6 个典型测试多峰图形进行最大值与最小值搜寻。
- 绘制最佳解的收敛曲线图。

作业参数

- 粒子数(40),
- 演算次数(30),
- 惯性权重(0.3),
- 个人最佳权重(0.5),
- 群体最佳权重(0.7)

绘制 2D 曲线图

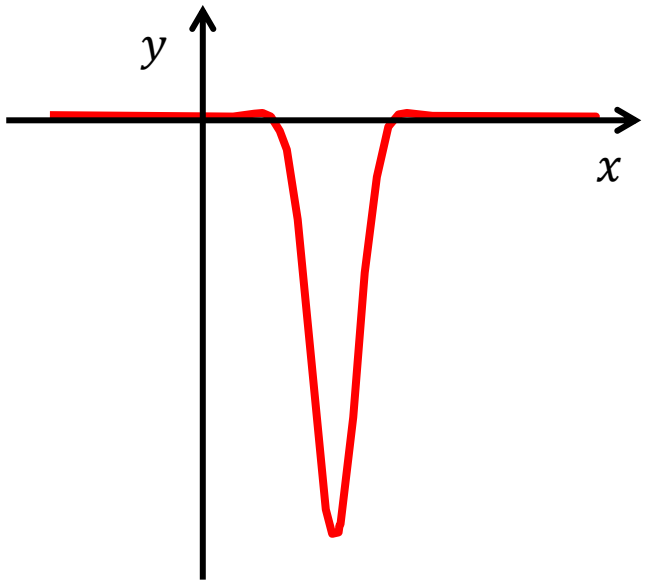
$$y = \cos(x)e^{\left(-(x-\pi)^2\right)},\ -3 \le x \le 10$$

x

-3.0	-2.9	-2.8	•••	9.8	9.9	10.0

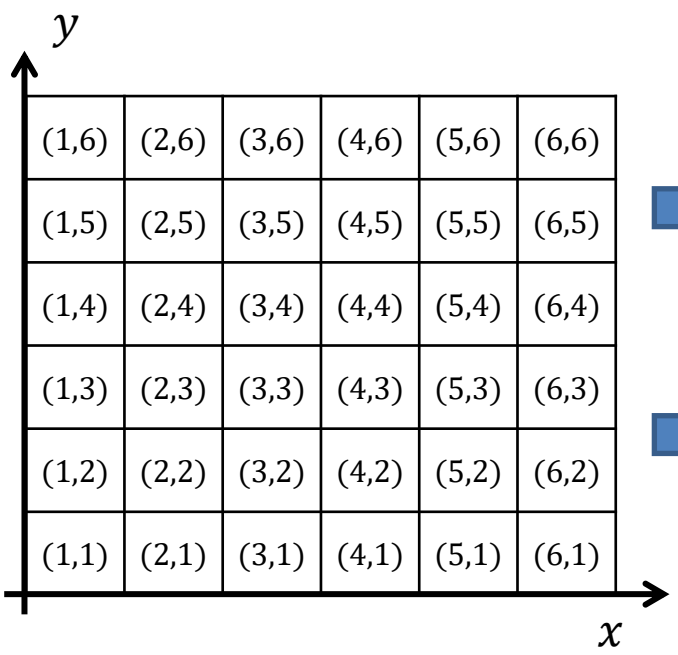
y

?	?	?	•••	?	?	?



绘制 3D 曲线图

$$z = 3(1-x)^2 e^{\left(-x^2-(y+1)^2\right)} - 10\left(\frac{x}{5} - x^3 - y^5\right)e^{\left(-x^2-y^2\right)} - \frac{1}{3}e^{\left(-(x+1)^2-y^2\right)}$$



y

6	6	6	6	6	6
5	5	5	5	5	5
4	4	4	4	4	4
3	3	3	3	3	3
2	2	2	2	2	2
1	1	1	1	1	1

x

1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6

z

?	?	?	?	?	?
?	?	?	?	?	?
?	?	?	?	?	?
?	?	?	?	?	?
?	?	?	?	?	?
?	?	?	?	?	?

※ Peaks Function 说明：

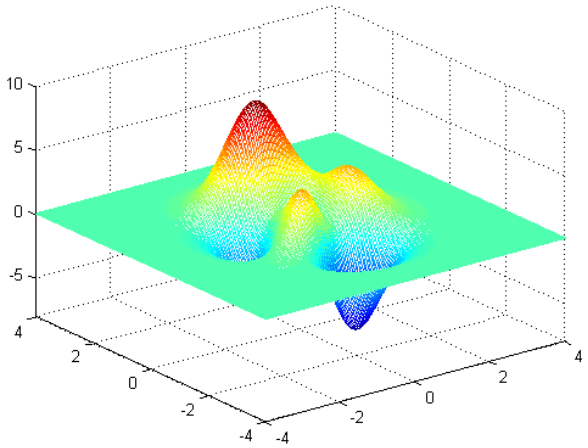
✓ 方程式：

$$3(1-x)^2 exp(-x^2-(y+1)^2) - 10\left(\frac{x}{5} - x^3 - y^5\right) exp(-x^2-y^2) - \frac{1}{3} exp(-(x+1)^2 - y^2)$$

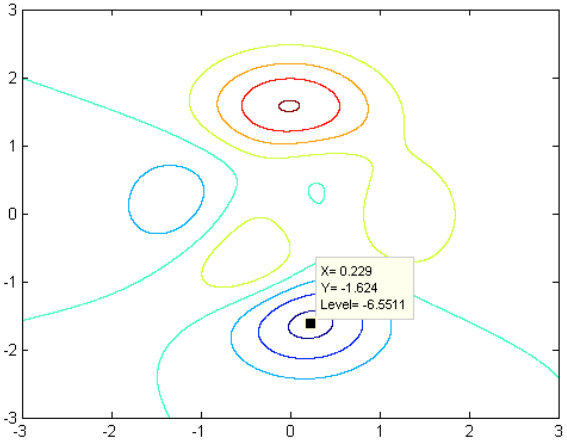
✓ 范围：$-3 \le x, y \le 3$

✓ 最小值：-6.5511，坐标为：$(0.229, -1.624)$

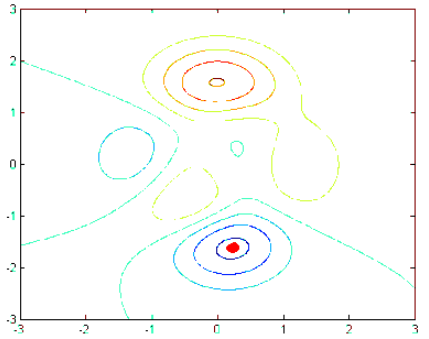
✓ 最大值：8.1062



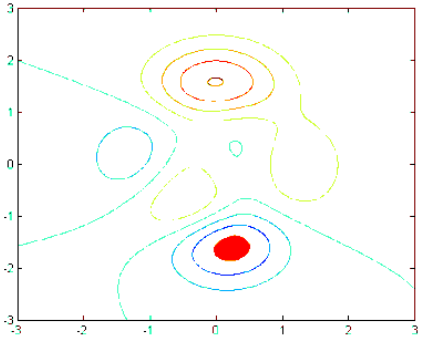
判断值：< -6.55



判断值：< -6.5



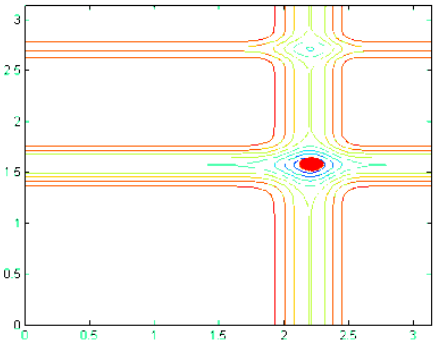
判断值：< -6



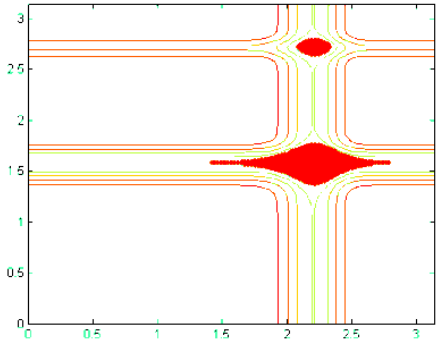
※ Michalewics Function 说明：

- ✓ 方程式：$f(x) = -\sum_{j=1}^{2} sin(x_j)\left(sin\left(j \times x_j^2/\pi\right)\right)^{20}$
- ✓ 范围：$0 \le x_{1,2} \le \pi$
- ✓ 最小值：-1.8013
- ✓ 坐标为：$(15.8, 22.1)$
- ~~✓ 最大值：0~~

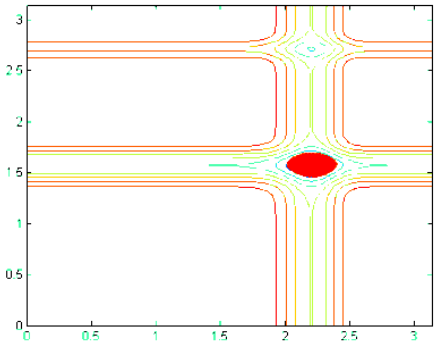
判断值：< -1.6



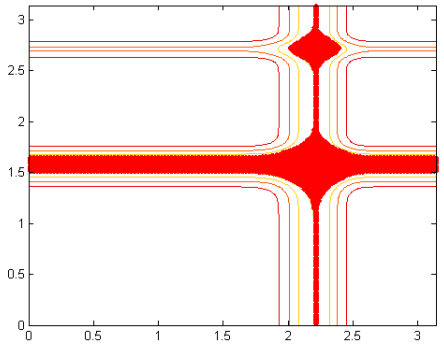
判断值：< -1



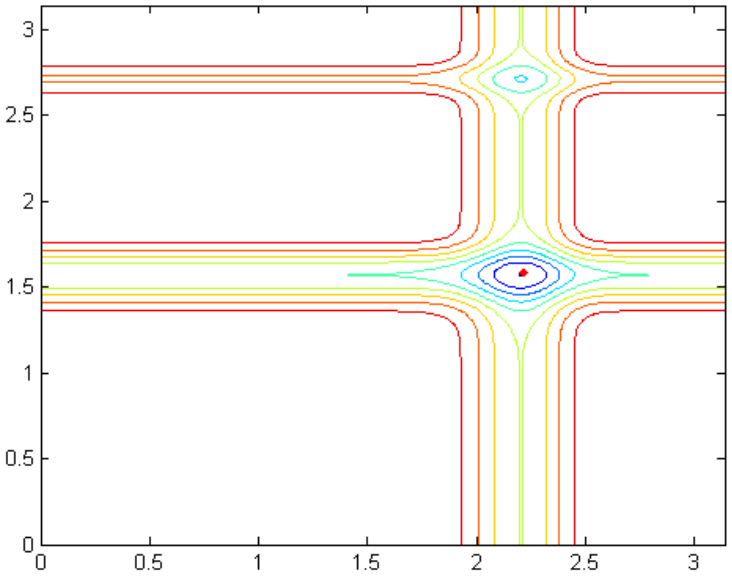
判断值：< -1.4



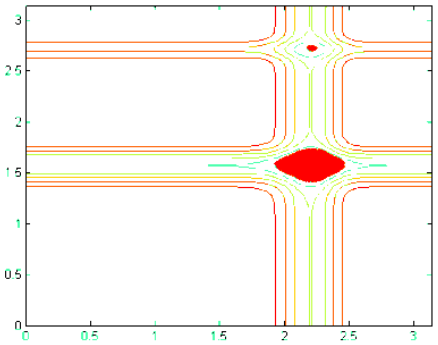
判断值：< -0.8

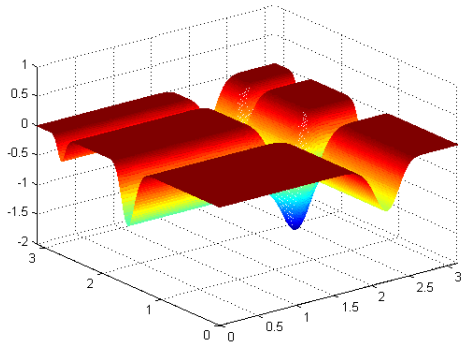


判断值：< -1.8



判断值：< -1.2



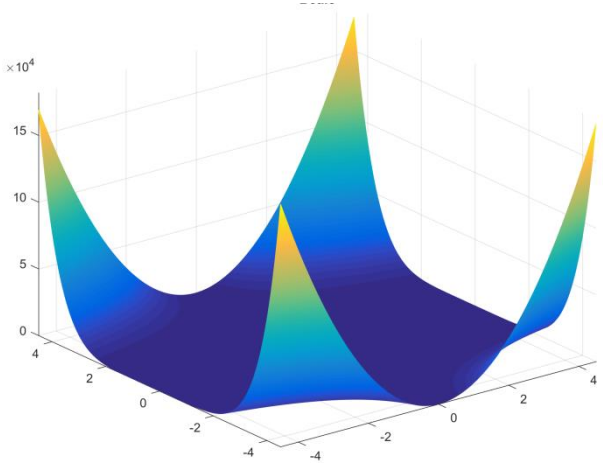


※ Beale Function 说明：

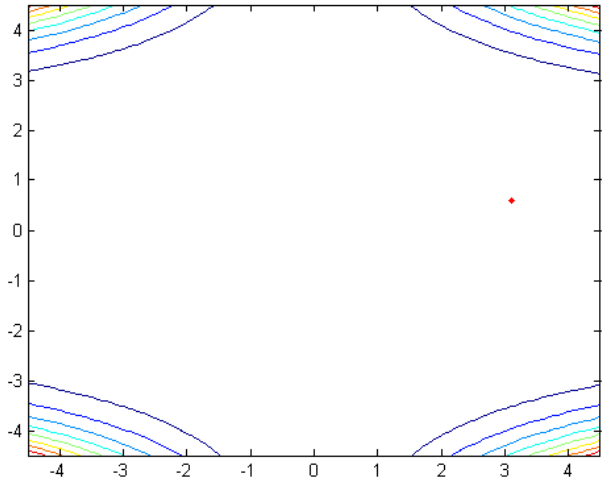
- ✓ 方程式：

  $(1.5 - x_1 + x_1x_2)^2 + (2.25 - x_1 + x_1x_2^2)^2 + (2.625 - x_1 + x_1x_2^3)^2$

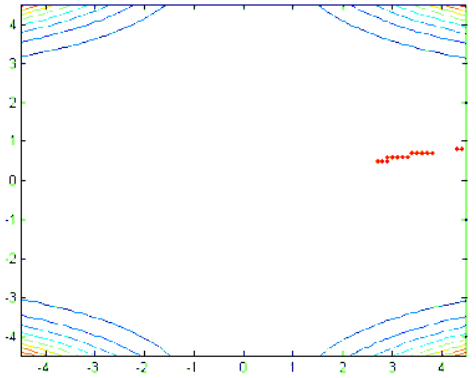
- ✓ 范围：$-4.5 \leq x_{1,2} \leq 4.5$
- ✓ 最小值：0
- ✓ 坐标为：(3.0, 0,5)
- ✓ 最大值：181853.6133



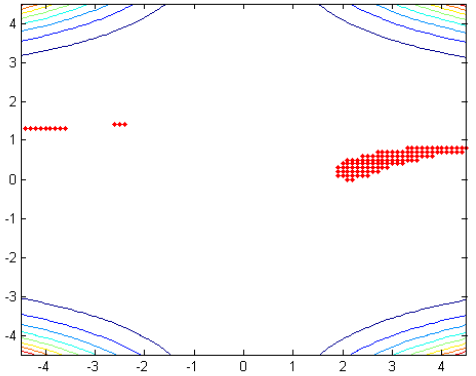
判断值：< 0.001



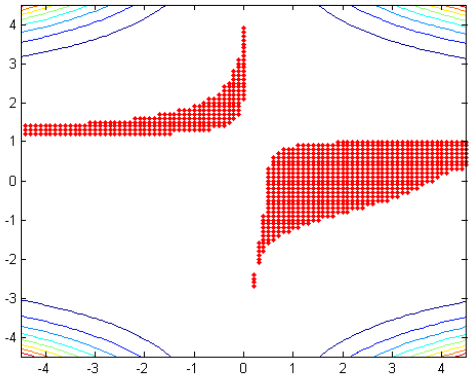
判断值：< 0.1



判断值：< 1

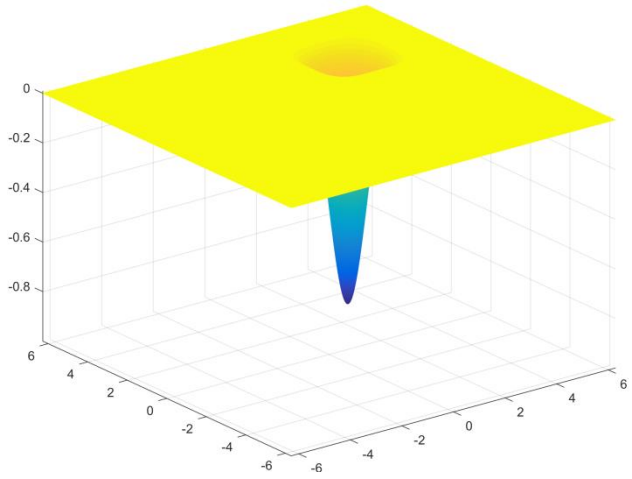


判断值：< 10

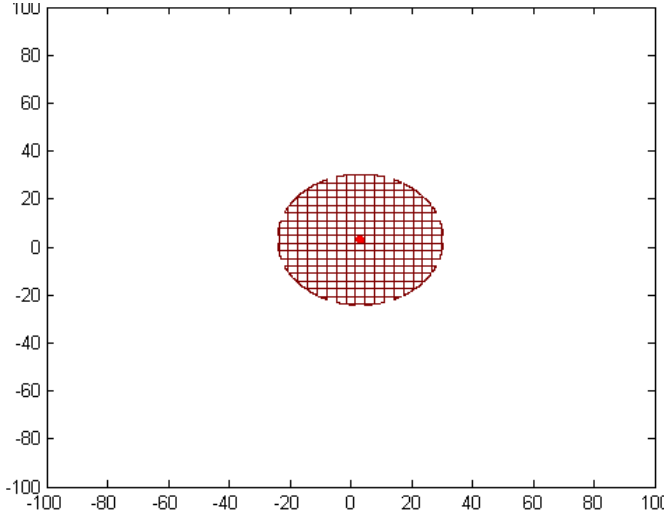


※ Easom Function 说明：

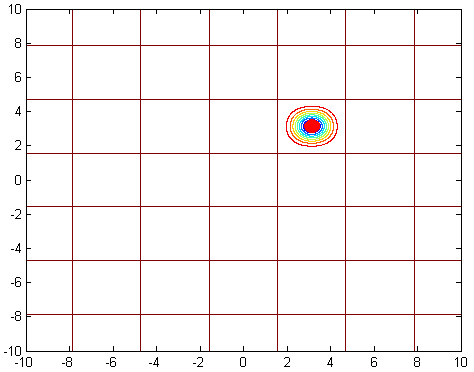
- ✓ 方程式：$-cos(x_1)cos(x_2)exp(-(x_1-\pi)^2-(x_2-\pi)^2)$
- ✓ 范围：$-100 \le x_{1,2} \le 100$
- ✓ 最小值：-1
- ✓ 坐标为：$(-\pi, \pi)$
- ✓ 最大值：0.0090



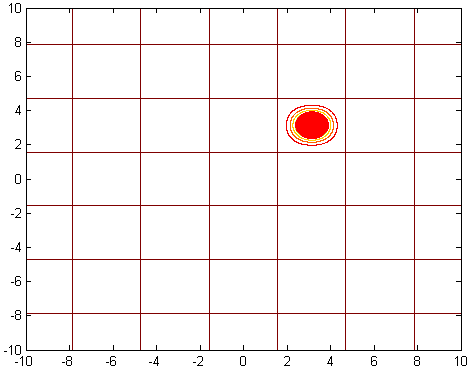
判断值：< -0.9948



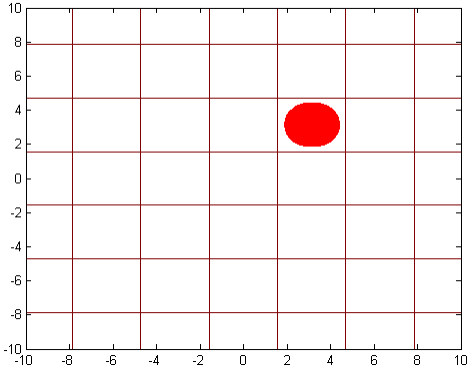
判断值：< -0.9



判断值：< -0.5



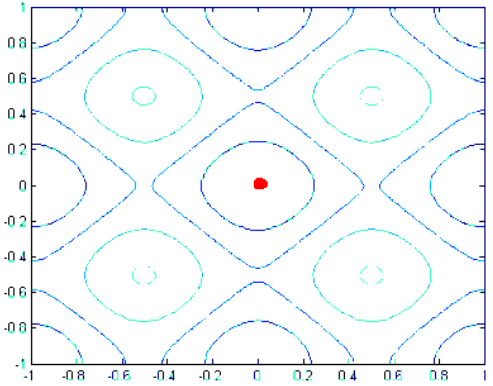
判断值：< -0.1



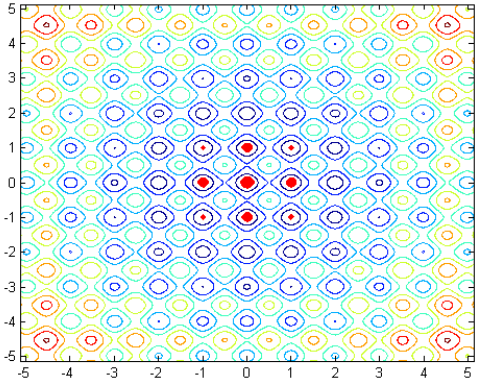
※ Rastrigin Function 说明：

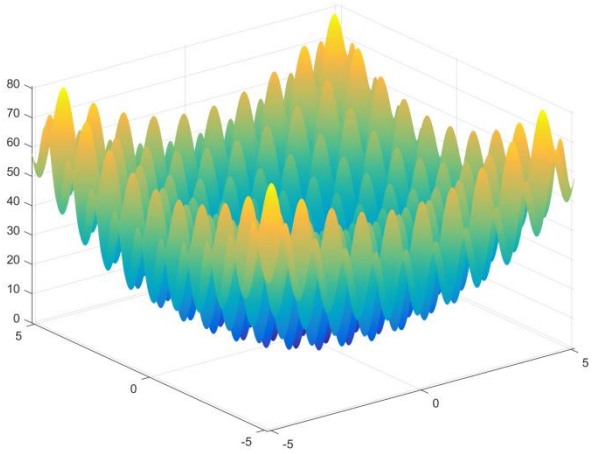
- ✓ 方程式：$10n + \sum_{i=1}^{n}\left(x_i^2 - 10cos(2\pi x_i)\right)$
- ✓ 范围：$-5.12 \le x_{1,2} \le 5.12$
- ✓ 最小值： 0
- ✓ 坐标为：$(0, 0)$
- ✓ 最大值： 80.7031

判断值：< 0.1

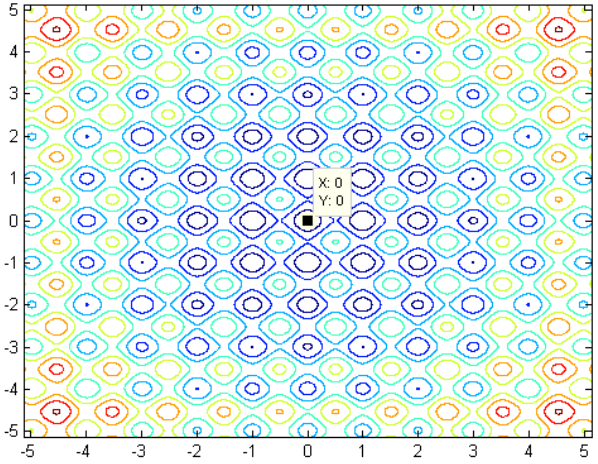


判断值：< 2

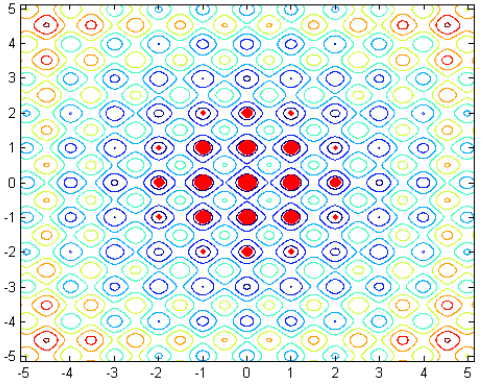




判断值：< 0.001

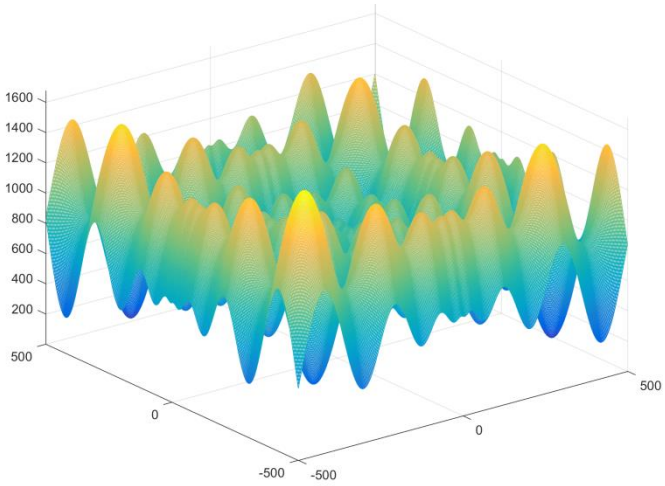


判断值：< 5



※ Schwefel Function 说明：

- ✓ 方程式：$418.9829n - \sum_{i=1}^{n}\left(x_i sin\sqrt{|x_i|}\right)$
- ✓ 范围：$-500 \le x_{1,2} \le 500$
- ✓ 最小值：2.7197e−004
- ✓ 坐标为：(422,422)
- ✓ 最大值：1675.93



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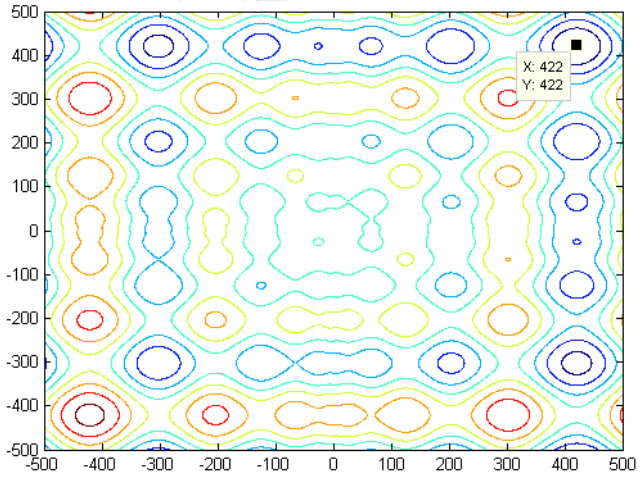
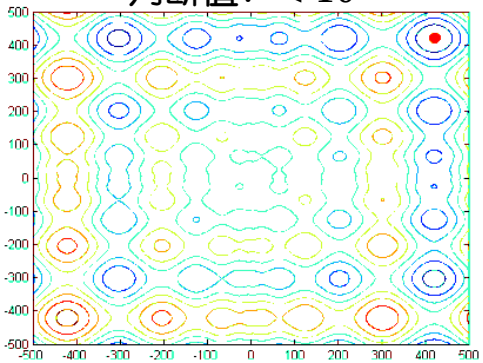
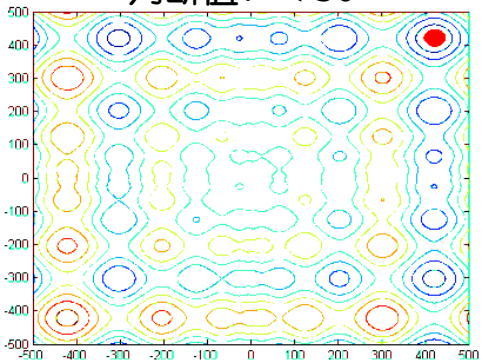


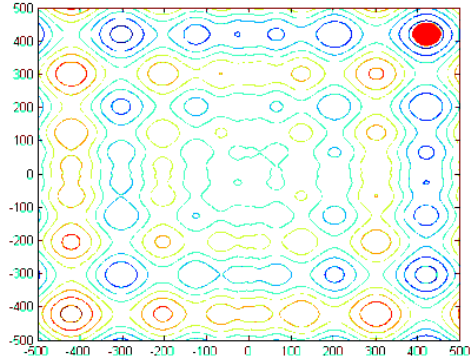
判断值：< 10



判断值：< 50



判断值：< 100



特殊数学符号的 matlab 相对应指令

- ✓ 自然对数e → exp()
- ✓ $\pi \rightarrow pi$
- ✓ 平方项 → □^2
- ✓ 开根号 →□^0.5 or $sqrt(□)$
- ✓ sin() → sin()
- ✓ ∑(□) → sum( )