第6讲　在 Mathematica 中作图

6－5　数据绘图

6－5－1　二维数据绘图

二维数据data表示：

{{x1, y1}, {x2, y2}, ...}	数据表 {{xi, yi}, i = 1, ..., n}
{y1, y2, ...}	数据表　{{1, y1}, {2, y2}, ...}

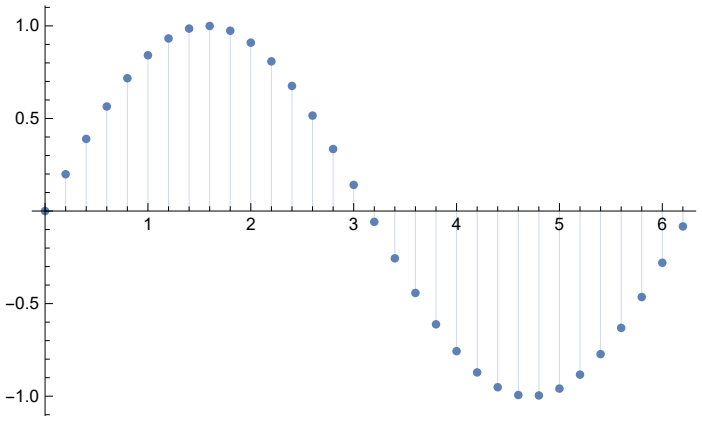
二维数据绘图命令：

ListPlot[data, 选项]	按选项用data绘制数据点集
ListPlot [data, Joined → True]	画一条通过数据点的光滑曲线
ListLinePlot[data, 选项]	按选项用数据data绘制曲线
ListPolarPlot[data, 选项]	在极坐标系下画离散点集data

例1：数据点列表.

In[14]:=
```
data = Table[{x, Sin[x]}, {x, 0, 2 Pi, 0.2}];
ListPlot[data, Filling → Axis]
```

Out[15]=



In[16]:=
```
ListPlot[data, Joined -> True, Filling → Axis]
```

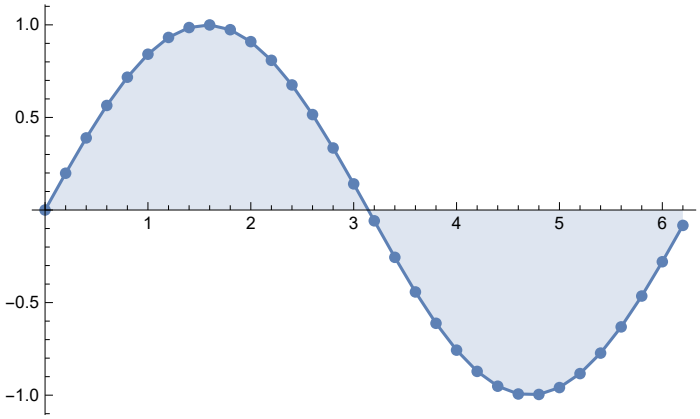
例2：数据曲线图.

```
ListLinePlot[data, Filling → Axis]
```

例3：选项：**Mesh** 曲面的网格线，曲线的取值点.

In[18]:=
```
ListPlot[data, Joined -> True, Filling → Axis, Mesh → Full]
```

Out[18]=



In[19]:=
```
ListLinePlot[data, Filling → Axis, Mesh → Full]
```

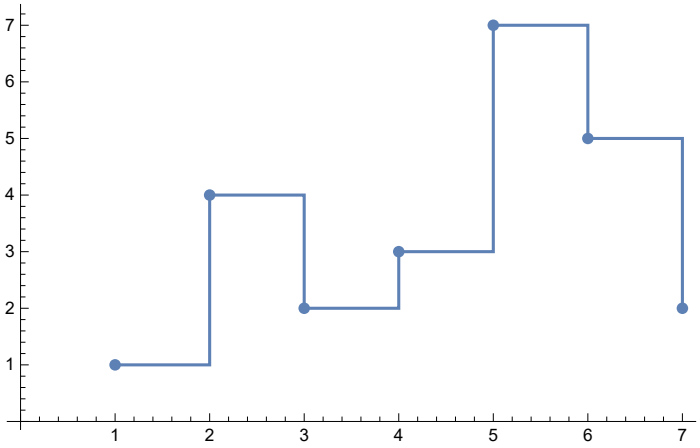
例4：将点连成线并标出点的位置.

In[20]:=
```
ListLinePlot[{{1, 4, 2, 3, 7, 5, 2}}, Mesh -> Full,
 MeshStyle -> Directive[PointSize[Large], Purple]]
```

例5：用分段常量 (零次插值) 连接离散点.

In[24]:=
```
ListLinePlot[{1, 4, 2, 3, 7, 5, 2}, InterpolationOrder → 0, Mesh → Full]
```

Out[24]=



例6：设置选项 **InterpolationOrder → 3**，用三次插值多项式近似离散点序列.

```
ListLinePlot[{1, 4, 2, 3, 7, 5, 2}, InterpolationOrder -> 3,
 Mesh -> Full, MeshStyle -> Directive[PointSize[0.02], Red]]
```

例7：画出函数**f (x) = (x - 1) (x - 1.5) (x - 2.7)** 在 **{0.75, 2.8}** 的极值点.

```
f[x_] = (x - 1) (x - 1.5) (x - 2.7); t = Plot[f[x], {x, 0.75, 2.8}]
```

```
sol = Solve[D[f[x], x] == 0, x]
```

```
u = x /. %
```

```
u = {sol[[1, 1, 2]], sol[[2, 1, 2]]}
```

```
data = Table[{u[[k]], f[u[[k]]]}, {k, 1, Length[u]}]
```

```
Show[t, ListPlot[data, PlotStyle → {Red, PointSize[Large]}]]
```

例8：画极坐标离散点列.

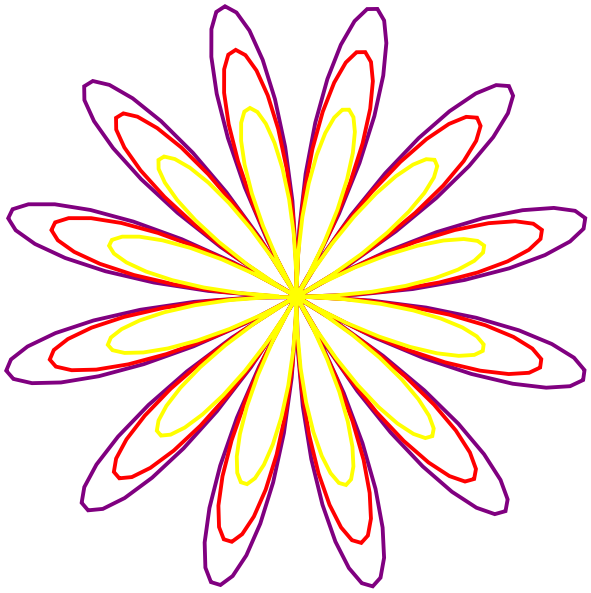
In[21]:=
```
ListPolarPlot[Table[θ, {θ, 0, 2 Pi, 0.1}]]
```

例9：画离散点列的极坐标图。

In[22]:=
```
t = Range[0, 12 Pi, 0.2];
```

In[23]:=
```
ListPolarPlot[{Sin[t], 0.85 Sin[t], 0.65 Sin[t]}, Joined -> True, Axes -> False,
 PlotStyle → {{Purple, Thick}, {Red, Thick}, {Yellow, Thick}}]
```

Out[23]=



6－5－2 三维数据绘图

二维数据data表示：{x, y}

{{x1, y1}, {x2, y2}, ...}　　数据表 {{xi, yi}, i = 1, ..., k}

{y1, y2, ...}　　数据表　{{1, y1}, {2, y2}, ...}

三维空间数据点表示： {x, y, z}

{{x1, y1, z1}, {x2, y2, z2} ...}　　向量点列

{{z11, ..., z1n}, ... {zm1, ..., zmn}}　　矩阵点列

{z11, ..., z1n} 为 {{1, 1, z11}, ..., {1, n, z1n}}

三维数据绘图命令 ：

ListPointPlot3D[{{x_1, y_1, z_1}, {x_2, y_2, z_2}, ...}]	点集的三维散点图
ListPlot3D[data]	在 {x_i, y_i} 处的高度为z_i 的三维曲面图 (点集三维图)
ListPlot3D[data, Mesh → Full]	绘制穿过所有每个数据点位置的网格

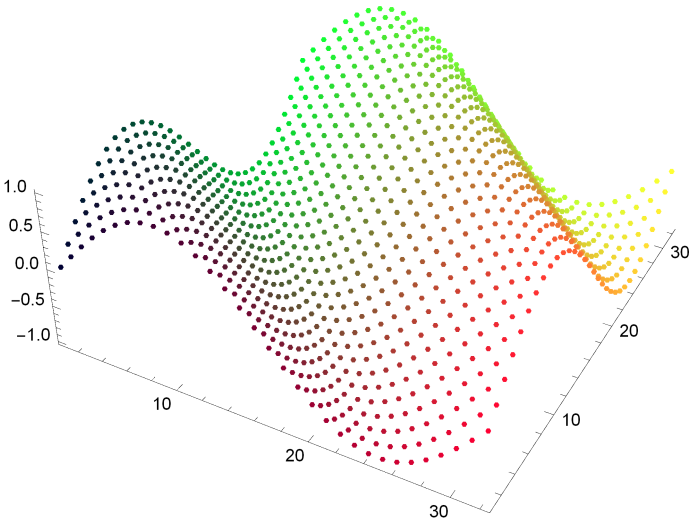
例1：u的点列定义：**Sin[i + j] {i, 0, 2 Pi, 0.2}, {j, 0, 2 Pi, 0.2} {i, j, Sin[i + j]}**
绘图时的点列：**{I, J, Sin[i + j]} , {I, 1, m}, {J = 1, m} m = Length[u]**

In[28]:=
```
u = Table[Sin[i + j], {i, 0, 2 Pi, 0.2}, {j, 0, 2 Pi, 0.2}];
```

In[29]:=
```
ListPointPlot3D[u, Boxed → False]
```

In[30]:=
```
ListPointPlot3D[u,
 ColorFunction → Function[{i, j}, RGBColor[i, j, 0.2]], Boxed → False]
```

Out[30]=



例2：观察和比较点列作图和函数作图.

In[33]:=
```
ListPlot3D[Table[Sin[x + y^2], {x, 0, Pi, 0.1}, {y, 0, Pi, 0.1}],
 ColorFunction → "DarkRainbow"]
```

In[34]:=
```
Plot3D[Sin[x + y^2], {x, 0, Pi}, {y, 0, Pi}, ColorFunction → "DarkRainbow"]
```

In[35]:=
```
ListPlot3D[Table[Sin[i + j^2], {i, 0, Pi, 0.1}, {j, 0, Pi, 0.1}], Filling -> Bottom]
```

例3：观察数据取 225，625 和 2500 点的图形效果.

In[36]:=
```
fdata[n_] := Table[Sin[0.01 (i + j)] + Cos[0.01 (i * j)], {i, 1, n}, {j, 1, n}];
ListPlot3D[fdata[15], Axes → False, Boxed → False]
```

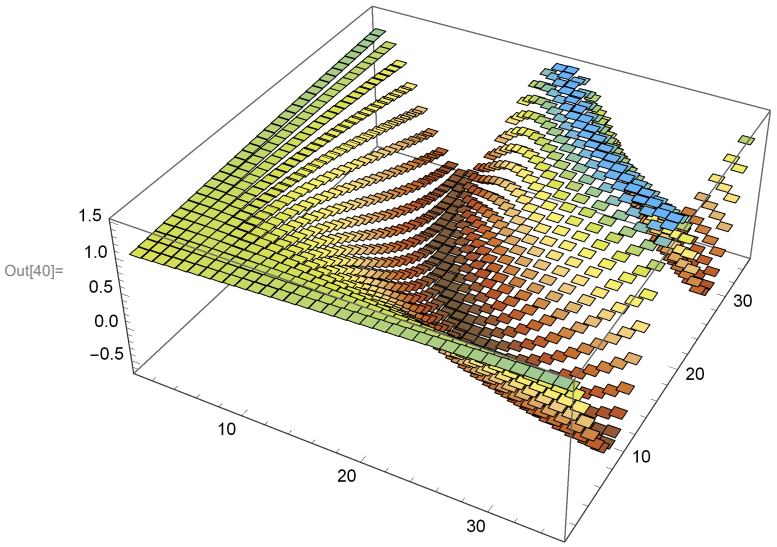
In[38]:=
```
ListPlot3D[fdata[35], Axes → False, Boxed → False]
```

```
ListPlot3D[fdata[50], Axes → False, Boxed → False]
```

例4：观察选项 Mesh → None , Mesh → 8 和 Mesh → All .

In[40]:=
```
ListPlot3D[fdata[35], Mesh → None,
 InterpolationOrder → 0, ColorFunction → "SouthwestColors"]
```

Out[40]=



In[41]:=
```
ListPlot3D[fdata[35], Axes → False, Boxed → False]
```

In[44]:=
```
ListPlot3D[fdata[35], Mesh → All,
 Boxed → False, ColorFunction → "SouthwestColors"]
```

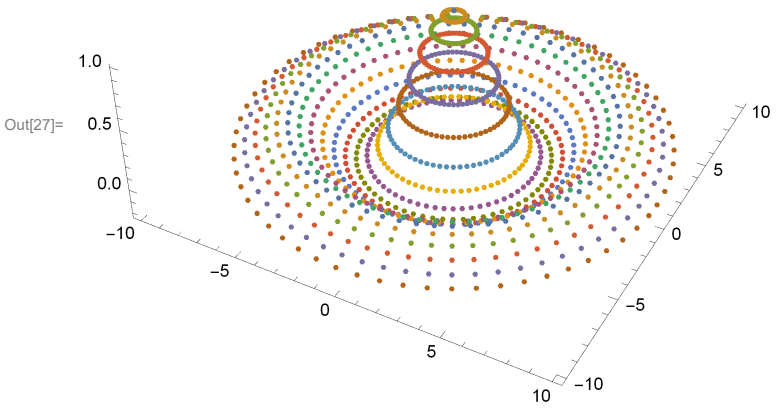
In[43]:=
```
ListPlot3D[fdata[35], Mesh → 8, Boxed → False]
```

例5：画一顶〝草帽〞.

In[25]:=
```
data = Table[{r Cos[t], r Sin[t], Sinc[r]}, {r, 0, 10, 0.5}, {t, 0, 2 Pi, 0.1}];
```

In[27]:=
```
ListPointPlot3D[data, Boxed → False]
```

Out[27]=



In[26]:=
```
{Plot[Sin[x] / x, {x, -10, 10}], Plot[Sinc[x], {x, -10, 10}]}
```