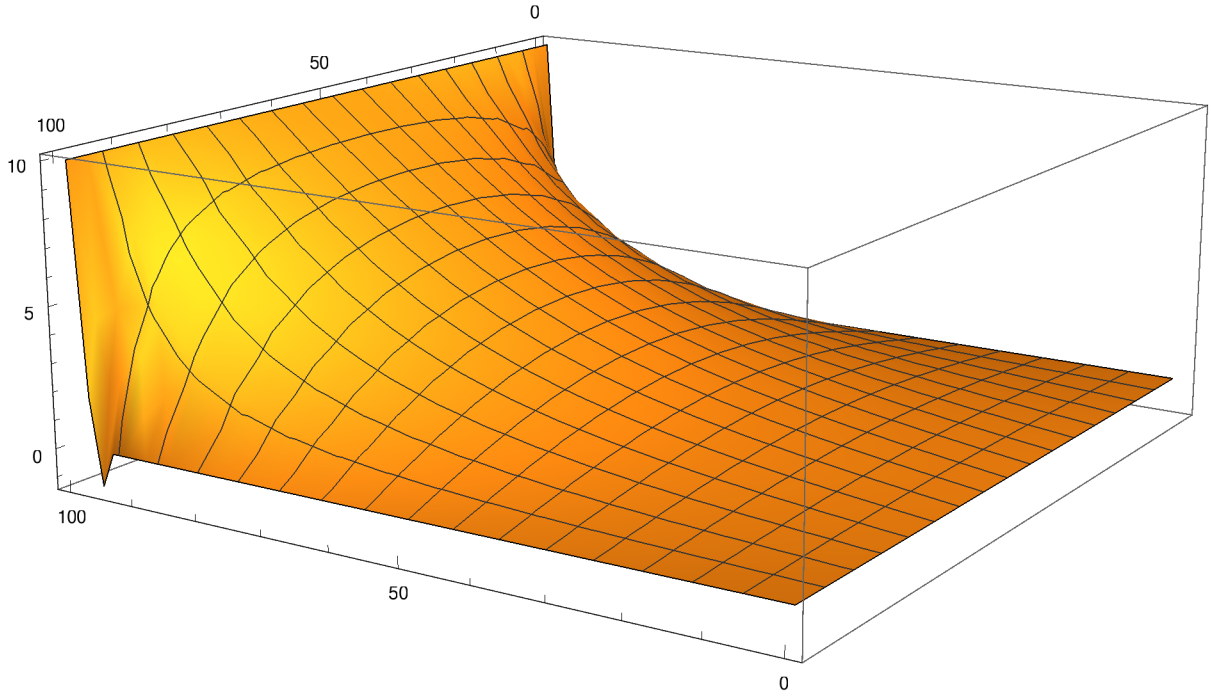
```
eqn = D[u[x, y], {x, 2}] + D[u[x, y], {y, 2}] == 0;

c1 = u[0, y] == 0;
c2 = u[100, y] == 10;
c3 = u[x, 0] == 0;
c4 = u[x, 100] == 0;

s = NDSolve[{eqn, c1, c2, c3, c4}, u, {x, 0, 100}, {y, 0, 100}]
```

```
{{u → InterpolatingFunction[ Domain: {{0., 100.}, {0., 100.}}
                             Output: scalar ]}}
```

```
Plot3D[Evaluate[u[x, y] /. %], {x, 0, 100}, {y, 0, 100}, PlotRange → All]
```



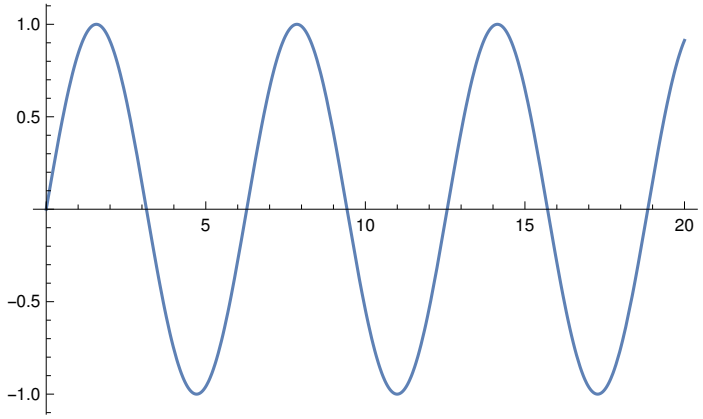

```
(*不加微扰的情况去*)
```

In[20]:=
```
a = 0.5;
ode1 = {x''[t] == -2 * a * x[t], x[0] == 0, x'[0] == 1};
xsol = NDSolve[ode1, x, {t, 0, 20}]
```

Out[22]=
```
{{x → InterpolatingFunction[ Domain: {{0., 20.}}
                             Output: scalar ]}}
```

In[23]:=
```
Plot[x[t] /. xsol, {t, 0, 20}]
```

Out[23]=

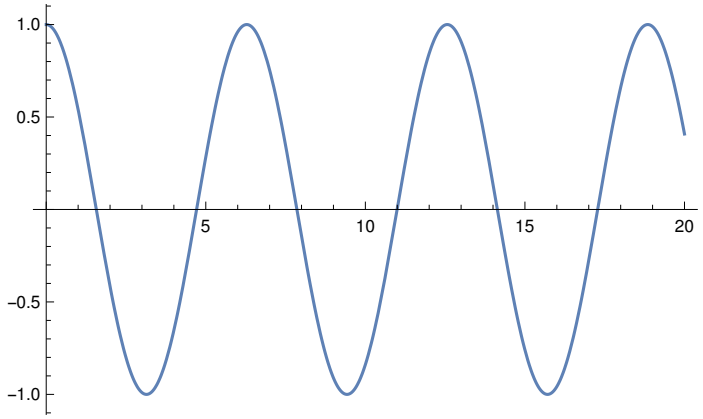


In[24]:=
```
ode2 = {y''[t] == -2 * a * y[t], y[0] == 1, y'[0] == 0};
ysol = NDSolve[ode2, y, {t, 0, 20}]
```

Out[25]=
```
{{y → InterpolatingFunction[ Domain: {{0., 20.}}
                             Output: scalar ]}}
```

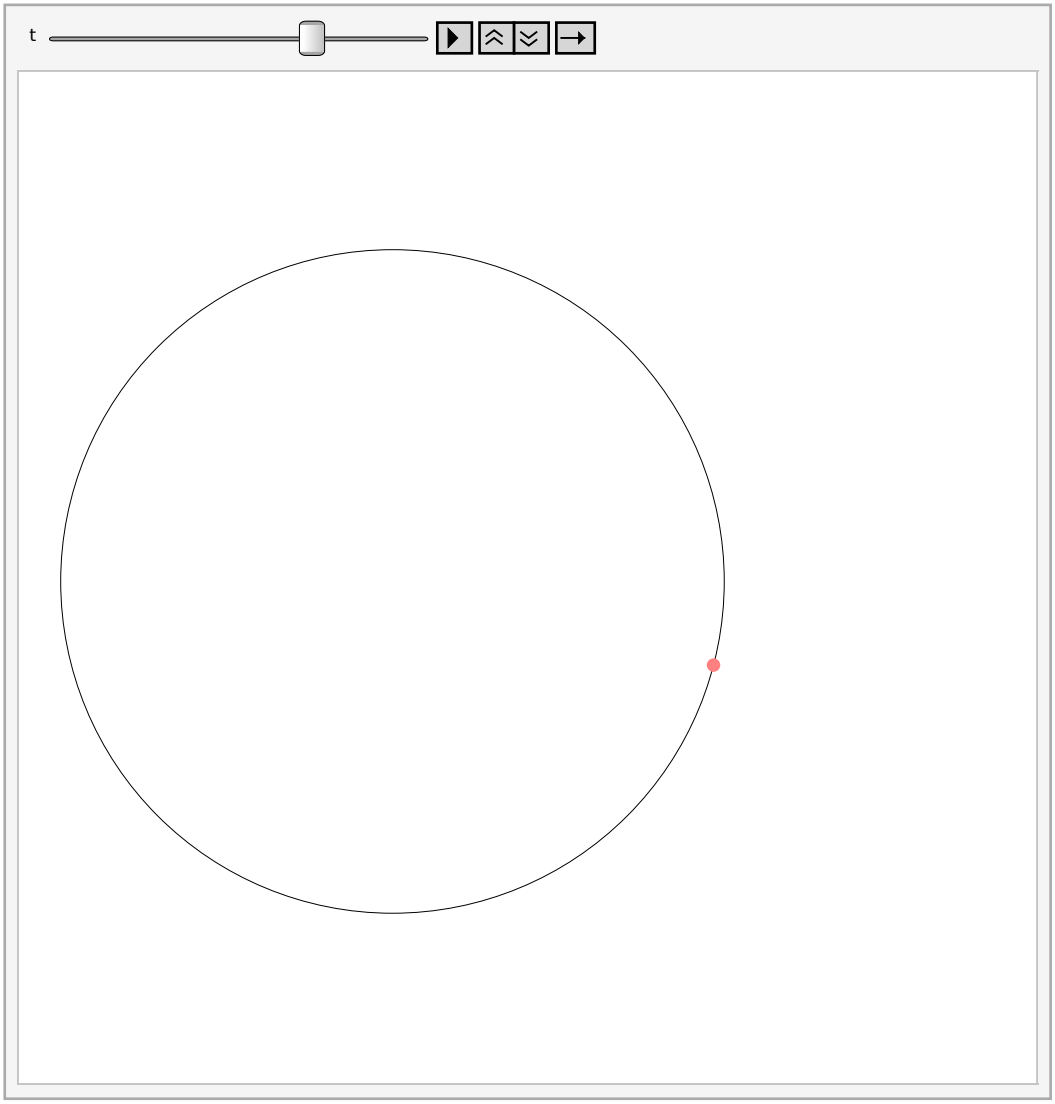
In[26]:=
```
Plot[y[t] /. ysol, {t, 0, 20}]
```

Out[26]=



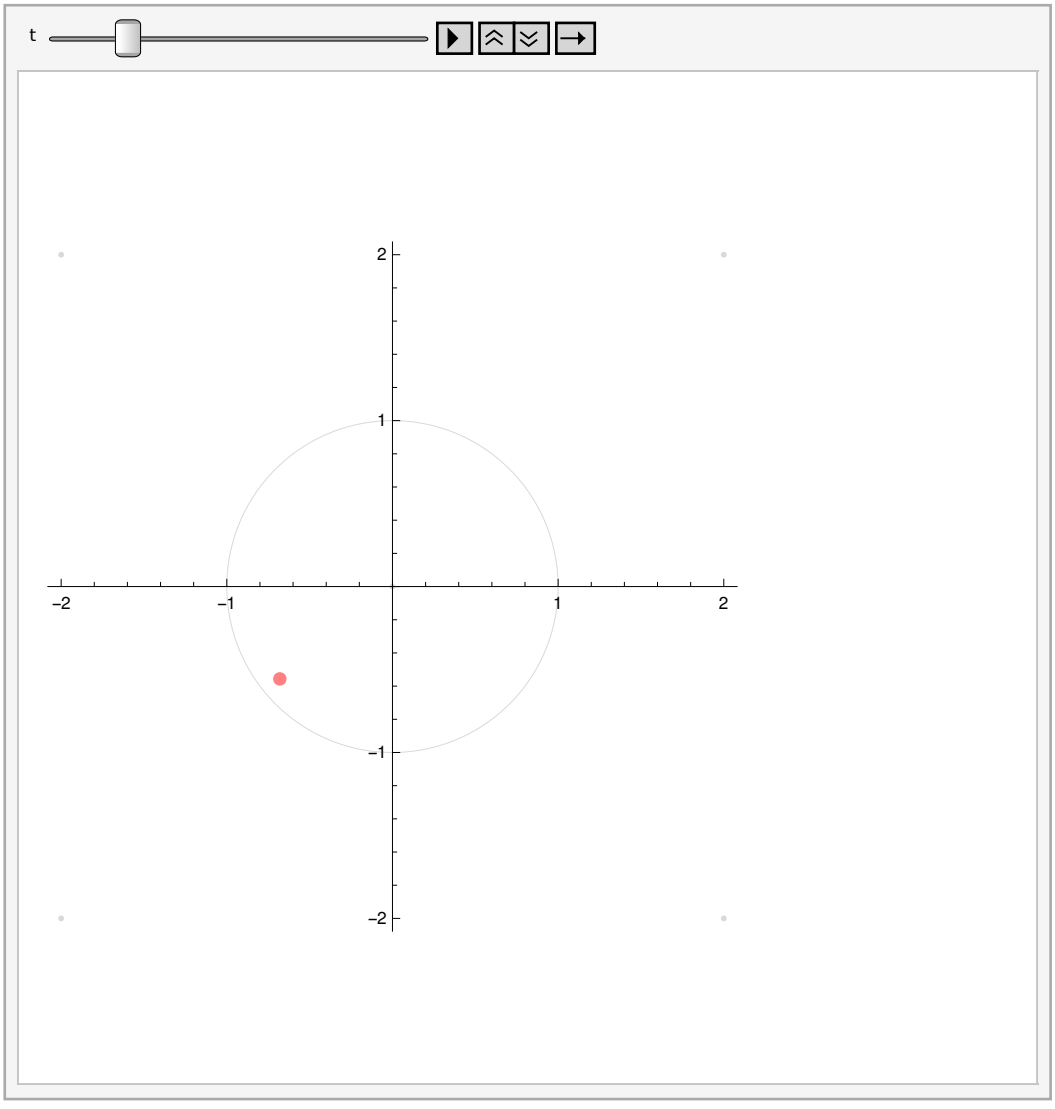
In[27]:=
```
Animate[Graphics[{Circle[], PointSize[Large],
   Pink, Point[{First[x[t] /. xsol], First[y[t] /. ysol]}]}],
 {t, 0, 20}, AnimationRunning → False]
```

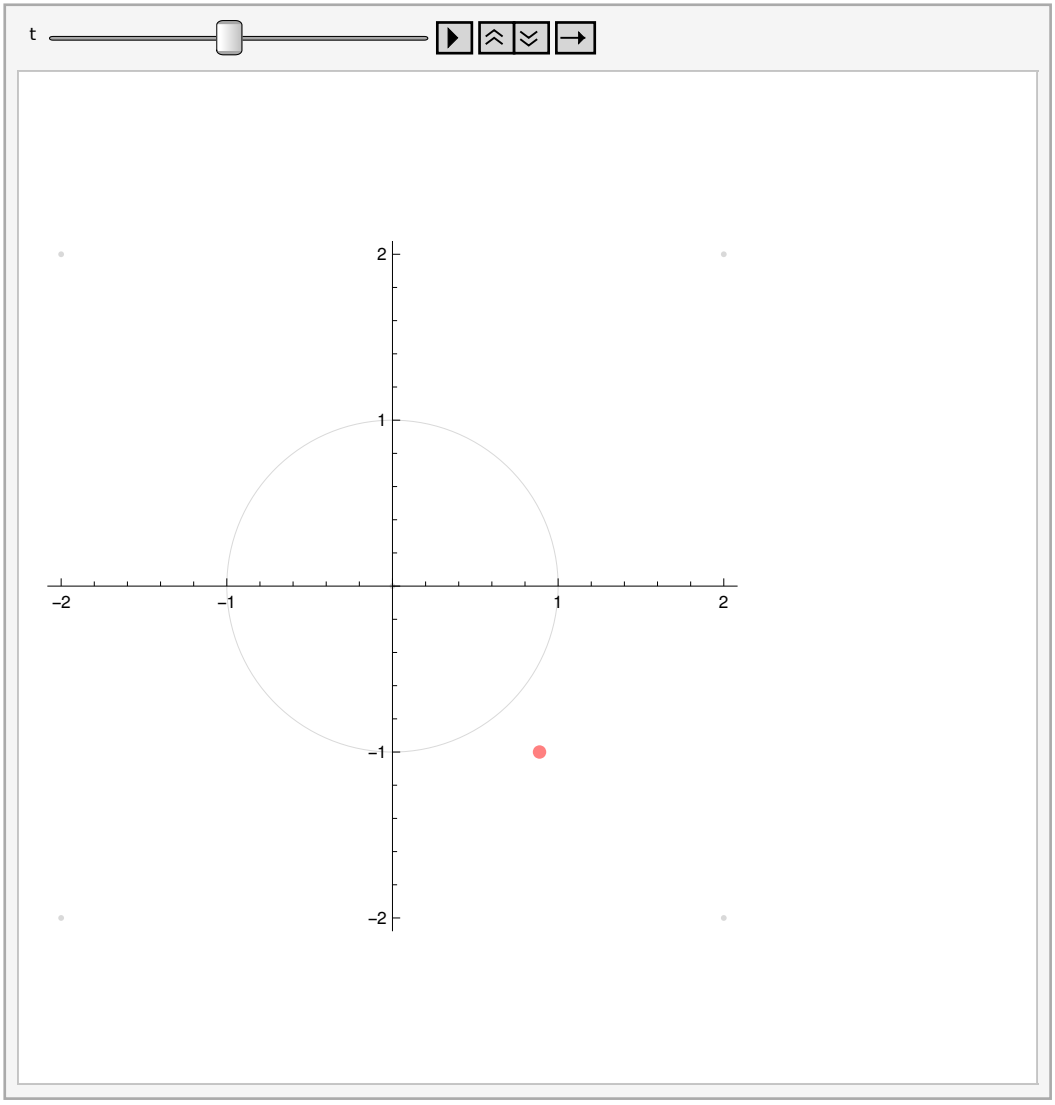
Out[27]=



In[42]:=
```
(*添加微扰*)
e1 = 0.1;
e2 = 0;
ode3 = {x''[t] == -2 * a * x[t] - 3 * e1 * (x[t])^2, x[0] == 0, x'[0] == 1};
xsol2 = NDSolve[ode3, x, {t, 0, 100}];
ode4 = {y''[t] == -2 * a * y[t] - 3 * e2 * (y[t])^2, y[0] == 1, y'[0] == 0};
ysol2 = NDSolve[ode4, y, {t, 0, 100}];
Animate[Graphics[{LightGray, Point[{0, 0}], Point[{-2, -2}], Point[{-2, 2}],
   Point[{2, 2}], Point[{2, -2}], Circle[{0, 0}, 1], PointSize[Large], Pink,
   Point[{First[x[t] /. xsol2], First[y[t] /. ysol2]}]}, AspectRatio → 1, Axes → True],
 {t, 0, 100}, AnimationRate → 1, RefreshRate → 60, DisplayAllSteps → True,
 AnimationRunning → True]
```

Out[48]=

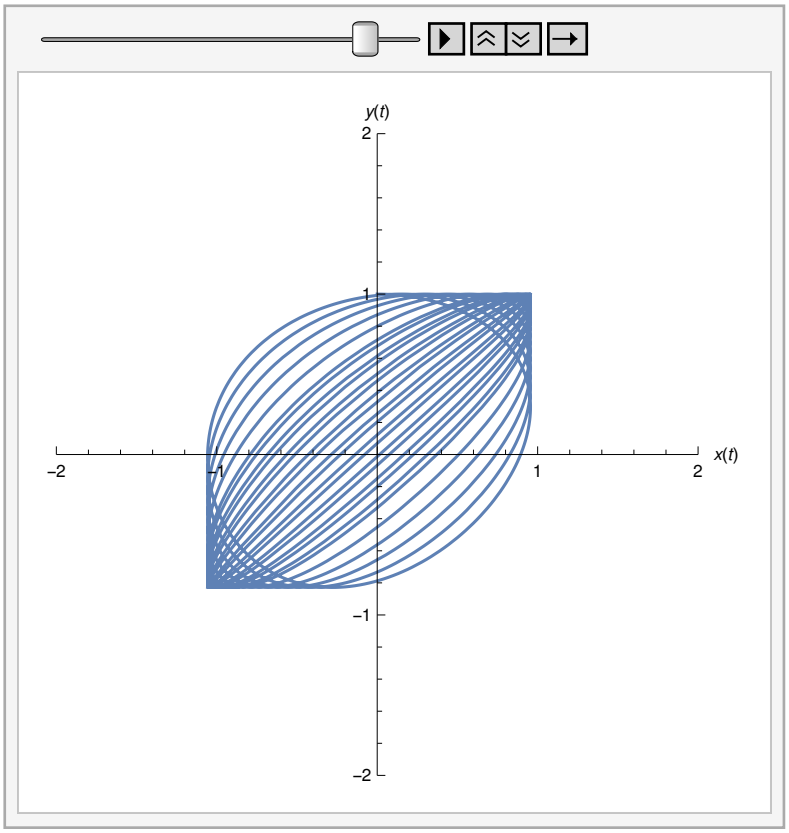



t
2
1
−2
−1
1
2
−1
−2

In[49]:=
```
e1 = 0.05;
e2 = -0.1;
sol =
  Quiet@NDSolve[{x''[t] == -2 * a * x[t] - 3 * e1 * (x[t])^2, x[0] == 0, x'[0] == 1, y''[t] ==
      -2 * a * y[t] - 3 * e2 * (y[t])^2, y[0] == 1, y'[0] == 0}, {x[t], y[t]}, {t, 0, 100}];
dat = Table[ParametricPlot[Evaluate[{x[t], y[t]} /. sol, {t, 0, tt},
    PlotRange → 2, AxesLabel → {x[t], y[t]}]], {tt, .1, 100, .2}];
SetDirectory@NotebookDirectory[]
ListAnimate[dat]
Export["home_3.gif", dat]
```

Out[53]= /home/jack/Documents/Wolfram Mathematica

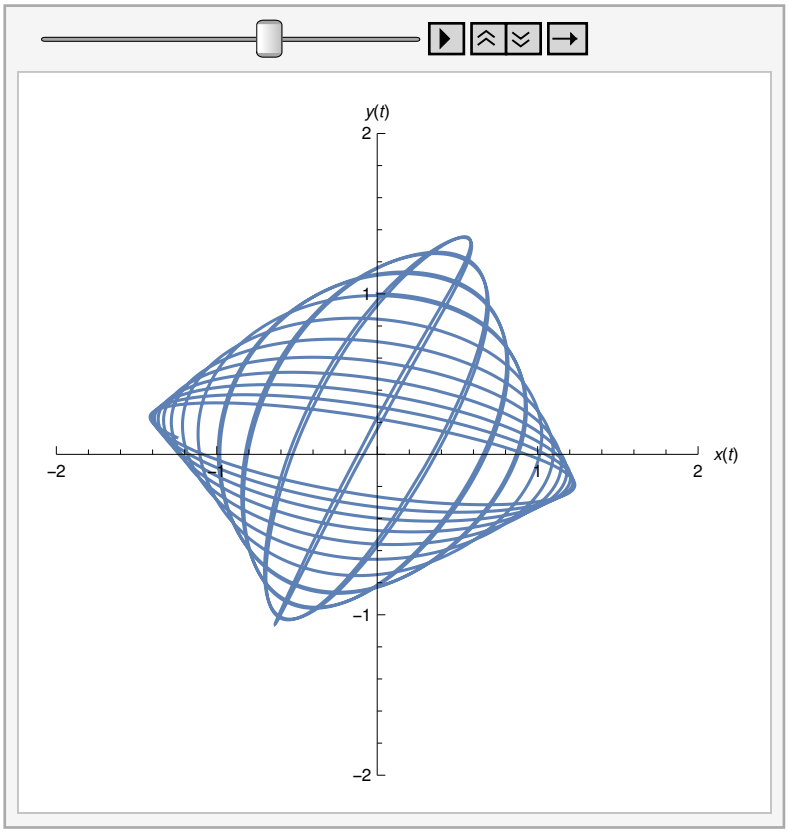
Out[54]=



Out[55]= home_3.gif

In[56]:=
```
a = 0.5;
e1 = 0.05;
e2 = -0.1;
e3 = 0.1;
sol = Quiet@NDSolve[
    {x''[t] == -(2 * a * x[t] + 3 * e1 * (x[t])^2 + 3 * e3 * (x[t])^2 * (y[t])^3), x[0] == 0,
     x'[0] == 1, y''[t] == -(2 * a * y[t] + 3 * e2 * (y[t])^2 + 3 * e3 * (x[t])^3 * (y[t])^2),
     y[0] == 1, y'[0] == 0}, {x[t], y[t]}, {t, 0, 150}];
dat = Table[ParametricPlot[Evaluate[{x[t], y[t]} /. sol, {t, 0, tt},
     PlotRange → 2, AxesLabel → {x[t], y[t]}]], {tt, .1, 150, .2}];
ListAnimate[dat]
SetDirectory@NotebookDirectory[]
```

Out[62]=



Out[63]= /home/jack/Documents/Wolfram Mathematica

In[19]:=
```
Export["home_4.gif", dat]
```

Out[19]= home_4.gif