

■ Two Pendula Coupled by a Spring

```
(Local) In[1]:=
Clear["Global`*"];
Off[General::spell1];
```

■ Setup the initial conditions - both pendula at rest

```
(Local) In[3]:=
init = {x1[0] == x10, x2[0] == x20,
        x1'[0] == 0, x2'[0] == 0};
```

■ Define the approximate (small angle) equations of motion and solve for x1[t] and x2[t]

```
(Local) In[4]:=
eqm = {x1''[t] == - (g/L)x1[t] - (k/m)(x1[t] - x2[t]),
        x2''[t] == - (g/L)x2[t] - (k/m)(x2[t] - x1[t])};
```

```
(Local) In[5]:=
eqm = Append[init, eqm];
```

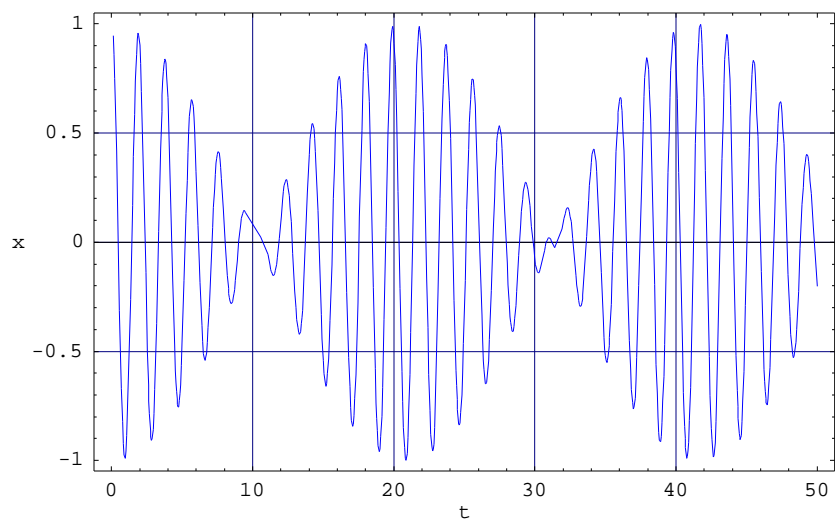
```
(Local) In[6]:=
dsol = DSolve[eqm, {x1[t], x2[t]}, t];
```

■ Define the constants to some useful values (weak coupling) and plot both x1 and x2 versus t

```
(Local) In[7]:=
val = {x10 == 1, x20 == 0, g == 10, L == 1, k == 1, m == 1};
```

```
(Local) In[8]:=
```

```
plot1 = ParametricPlot[  
  Evaluate[{t, x1[t]} /. dsol /. val], {t, 0.1, 50}, PlotStyle  $\rightarrow$  RGBColor[0, 0, 1],  
  GridLines  $\rightarrow$  Automatic, Frame  $\rightarrow$  True, FrameLabel  $\rightarrow$  {"t", "x"}, RotateLabel  $\rightarrow$  False];
```



```
(Local) In[9]:=
```

```
plot2 = ParametricPlot[Evaluate[{t, x2[t]} /. dsol /. val],  
  {t, 0.1, 50}, PlotStyle  $\rightarrow$  RGBColor[1, 0, 0], GridLines  $\rightarrow$  Automatic,  
  Frame  $\rightarrow$  True, FrameLabel  $\rightarrow$  {"t", "x"}, RotateLabel  $\rightarrow$  False];
```

