

```

<< Notation`;

Symbolize[u1^t]; Symbolize[u2^t]; Symbolize[u3^t]; Symbolize[u1^t];
Symbolize[u2^t]; Symbolize[u3^t]; Symbolize[u1^t]; Symbolize[u2^t];
Symbolize[u3^t]; Symbolize[u1^t+Δt]; Symbolize[u2^t+Δt]; Symbolize[u3^t+Δt];
Symbolize[u1^t+Δt]; Symbolize[u2^t+Δt]; Symbolize[u3^t+Δt]; Symbolize[u1^t+Δt];
Symbolize[u2^t+Δt]; Symbolize[u3^t+Δt]; Symbolize[u1^t+γΔt];
Symbolize[u2^t+γΔt]; Symbolize[u3^t+γΔt]; Symbolize[u1^t+γΔt];
Symbolize[u2^t+γΔt]; Symbolize[u3^t+γΔt]; Symbolize[u1^t+γΔt];
Symbolize[u2^t+γΔt]; Symbolize[u3^t+γΔt]; Symbolize[β1]; Symbolize[β2];

For[
  ClearAll["Global`*"];
  γ = 1/2; Δt = 0.25; β2 = 2 β1;
  m2 = 1;
  m3 = 1;
  k2 = 1;
  ω = 1.2;
  u1^t+Δt = Sin[ω p];
  u1^t+γΔt = Sin[ω (p - Δt/2)];
  eq112 = m2 u2^t+γΔt + (k1 + k2) u2^t+γΔt + (-k2) u3^t+γΔt == k1 u1^t+γΔt;
  eq113 = m3 u3^t+γΔt + (-k2) u2^t+γΔt + k2 u3^t+γΔt == 0;
  eq122 = u2^t+γΔt == u2^t + (γ Δt / 2) (u2^t + u2^t+γΔt);
  eq123 = u3^t+γΔt == u3^t + (γ Δt / 2) (u3^t + u3^t+γΔt);
  eq132 = u2^t+γΔt == u2^t + (γ Δt / 2) (u2^t + u2^t+γΔt);
  eq133 = u3^t+γΔt == u3^t + (γ Δt / 2) (u3^t + u3^t+γΔt);
  eq212 = m2 u2^t+Δt + (k1 + k2) u2^t+Δt + (-k2) u3^t+Δt == k1 u1^t+Δt;
  eq213 = m3 u3^t+Δt + (-k2) u2^t+Δt + k2 u3^t+Δt == 0;
  eq222 = u2^t+Δt == u2^t + γ Δt ((1 - β1) u2^t + β1 u2^t+γΔt) + (1 - γ) Δt ((1 - β2) u2^t+γΔt + β2 u2^t+Δt);
  eq223 = u3^t+Δt == u3^t + γ Δt ((1 - β1) u3^t + β1 u3^t+γΔt) + (1 - γ) Δt ((1 - β2) u3^t+γΔt + β2 u3^t+Δt);
  eq232 = u2^t+Δt == u2^t + γ Δt ((1 - β1) u2^t + β1 u2^t+γΔt) + (1 - γ) Δt ((1 - β2) u2^t+γΔt + β2 u2^t+Δt);
  eq233 = u3^t+Δt == u3^t + γ Δt ((1 - β1) u3^t + β1 u3^t+γΔt) + (1 - γ) Δt ((1 - β2) u3^t+γΔt + β2 u3^t+Δt);
  sland2 = Solve[eq112 && eq113 && eq122 && eq123 && eq132 &&
    eq133 && eq212 && eq213 && eq222 && eq223 && eq232 && eq233,
    {u2^t+γΔt, u3^t+γΔt, u2^t+γΔt, u3^t+γΔt, u2^t+γΔt, u3^t+γΔt, u2^t+Δt, u3^t+Δt, u2^t+Δt, u3^t+Δt, u2^t+Δt, u3^t+Δt}];

  u2^t+Δt = u2^t+Δt /. sland2[[1, 7]];
  u3^t+Δt = u3^t+Δt /. sland2[[1, 8]];

```

```

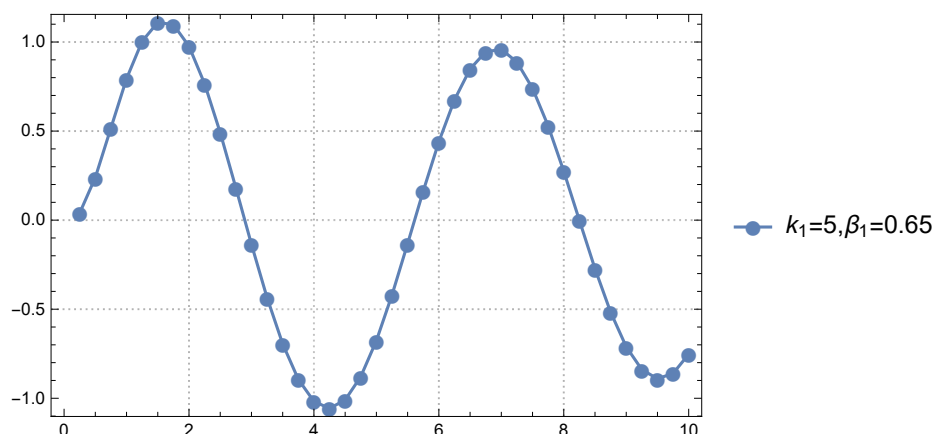
 $\dot{u}_2^{t+\Delta t} = \dot{u}_2^{t+\Delta t} /. s1and2[[1, 9]];$ 
 $\dot{u}_3^{t+\Delta t} = \dot{u}_3^{t+\Delta t} /. s1and2[[1, 10]];$ 
 $u_2^{t+\Delta t} = u_2^{t+\Delta t} /. s1and2[[1, 11]];$ 
 $u_3^{t+\Delta t} = u_3^{t+\Delta t} /. s1and2[[1, 12]];$ 
 $k_1 = 5; \beta_1 = 0.65;$ 
 $p = 0.25; \dot{u}_2^t = 0; \dot{u}_3^t = 0; \dot{u}_2^t = 0; \dot{u}_3^t = 0; u_2^t = 0; u_3^t = 0,$ 
 $p \leq 30,$ 
 $p = p + 0.25,$ 
 $uk005b0652_p = u_2^{t+\Delta t};$ 
 $uk005b0653_p = u_3^{t+\Delta t};$ 
 $uk005b065d2_p = \dot{u}_2^{t+\Delta t};$ 
 $uk005b065d3_p = \dot{u}_3^{t+\Delta t};$ 
 $uk005b065dd2_p = \dot{u}_2^{t+\Delta t};$ 
 $uk005b065dd3_p = \dot{u}_3^{t+\Delta t};$ 
 $\dot{u}_2^t = \dot{u}_2^{t+\Delta t}; \dot{u}_3^t = \dot{u}_3^{t+\Delta t}; \dot{u}_2^t = \dot{u}_2^{t+\Delta t}; \dot{u}_3^t = \dot{u}_3^{t+\Delta t}; u_2^t = u_2^{t+\Delta t}; u_3^t = u_3^{t+\Delta t}$ 
];

```

```

DiscretePlot[{uk005b0652_p}, {p, 0, 10, Δt},
  PlotLegends -> {"k1=5,β1=0.65"}, PlotTheme -> "Detailed",
  Joined -> True, PlotMarkers -> {Automatic, 12}, FillingStyle -> White]

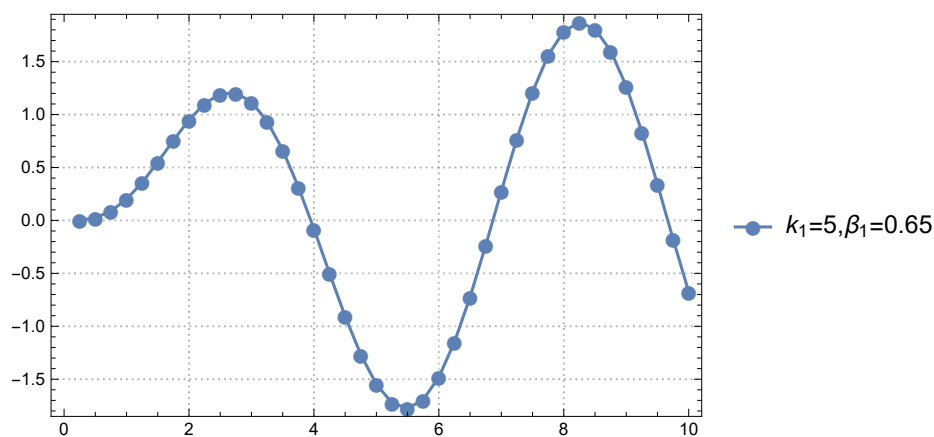
```



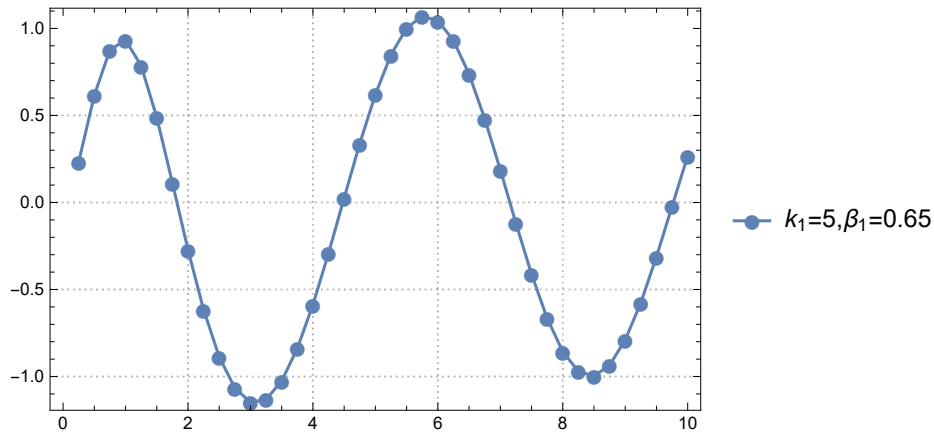
```

DiscretePlot[{uk005b0653_p}, {p, 0, 10, Δt},
  PlotLegends -> {"k1=5,β1=0.65"}, PlotTheme -> "Detailed",
  Joined -> True, PlotMarkers -> {Automatic, 12}, FillingStyle -> White]

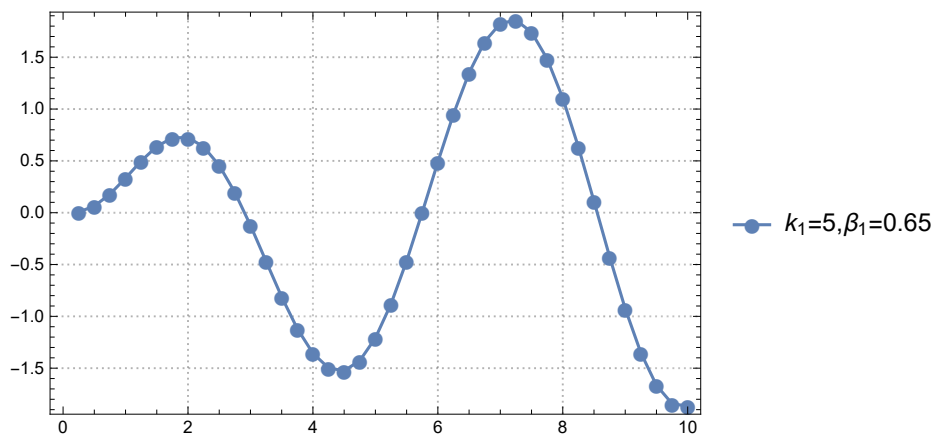
```



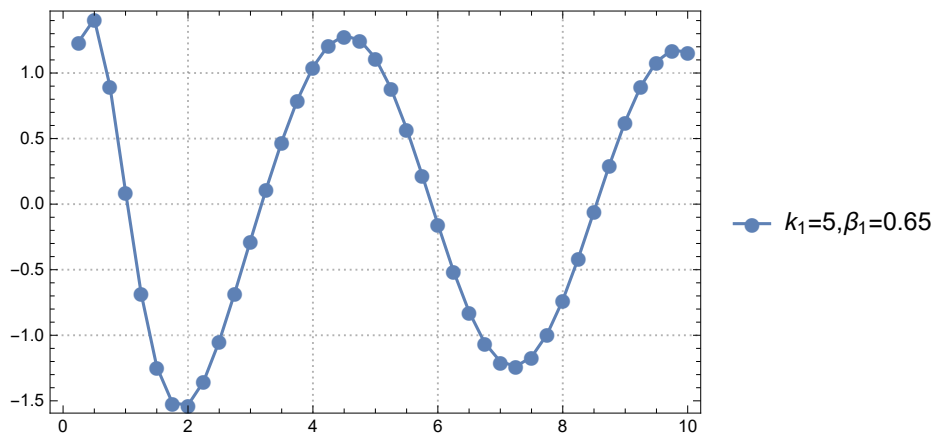
```
DiscretePlot[{uk005b065d2p}, {p, 0, 10, Δt},
  PlotLegends -> {"k1=5,β1=0.65"}, PlotTheme -> "Detailed",
  Joined -> True, PlotMarkers -> {Automatic, 12}, FillingStyle -> White]
```



```
DiscretePlot[{uk005b065d3p}, {p, 0, 10, Δt},
  PlotLegends -> {"k1=5,β1=0.65"}, PlotTheme -> "Detailed",
  Joined -> True, PlotMarkers -> {Automatic, 12}, FillingStyle -> White]
```



```
DiscretePlot[{uk005b065dd2p}, {p, 0, 10, Δt},
  PlotLegends -> {"k1=5,β1=0.65"}, PlotTheme -> "Detailed",
  Joined -> True, PlotMarkers -> {Automatic, 12}, FillingStyle -> White]
```



```
DiscretePlot[{uk005b065dd3p}, {p, 0, 10, Δt},
  PlotLegends -> {" $k_1=5, \beta_1=0.65$ "}, PlotTheme -> "Detailed",
  Joined -> True, PlotMarkers -> {Automatic, 12}, FillingStyle -> White]
```

