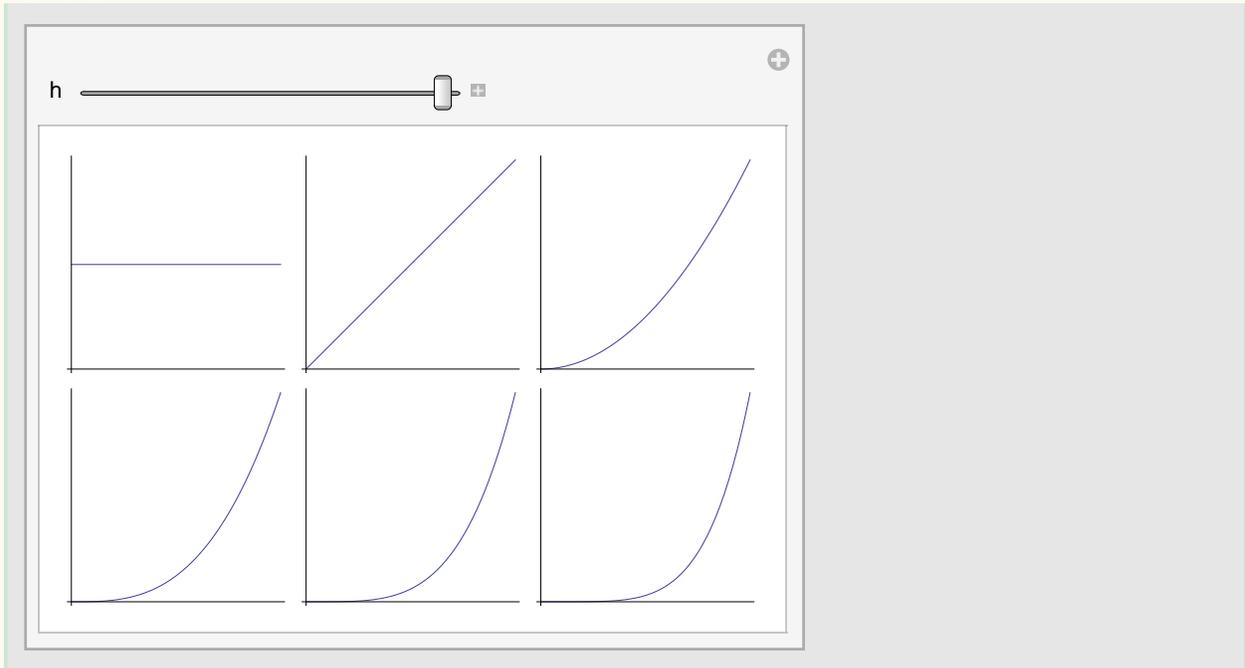# Pecha - Kucha

□ **Oliver Knill, March 6, 2013**

Here is some Mathematica code illustrating some of the slides of the talk.

The deformed Polynomials

(Debug) (Dialog) In[245]:=

```
Pow[x_, h_, n_] := Product[(x - h j), {j, 0, n - 1}];
Manipulate[GraphicsGrid[Partition[
    Table[Plot[Pow[x, h, k], {x, 0, 3}, Ticks → None, AspectRatio → 1], {k, 0, 5}], 3]], {h, 1, 0.01}]
```
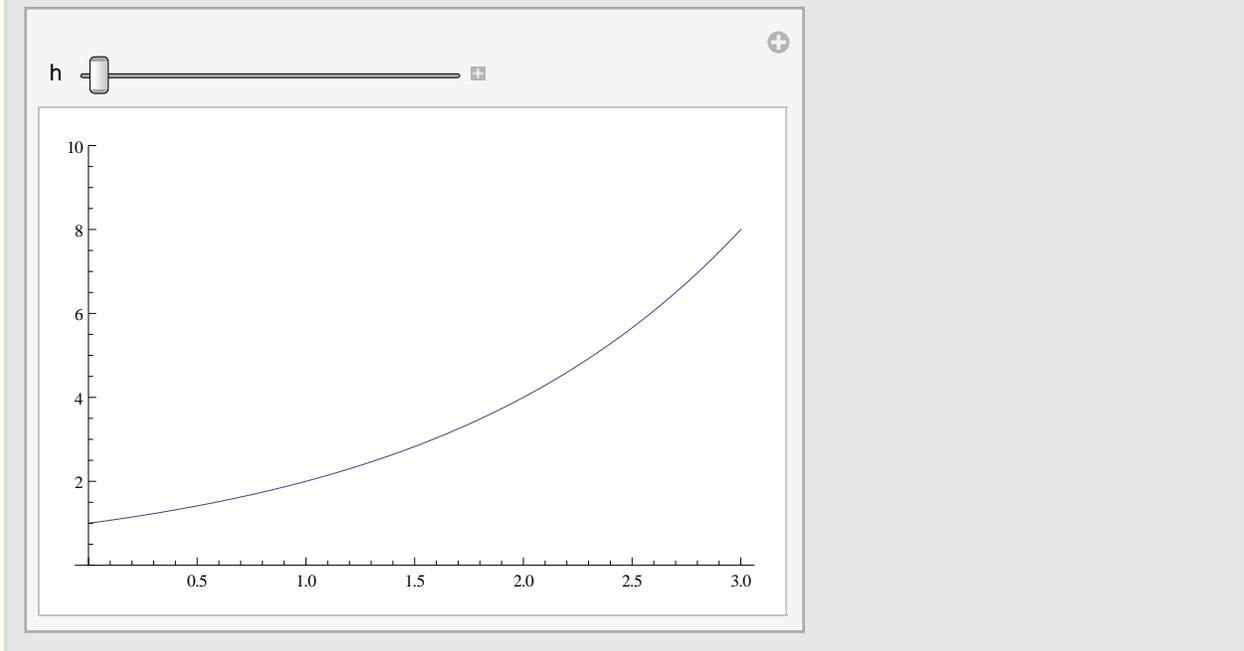
(Debug) (Dialog) Out[246]=

The deformed Exponential

(Debug) (Dialog) In[237]:=

```
Manipulate[Plot[(1 + h) ^ (x / h), {x, 0, 3}, PlotRange → {0, 10}], {h, 1, 0.01}]
```
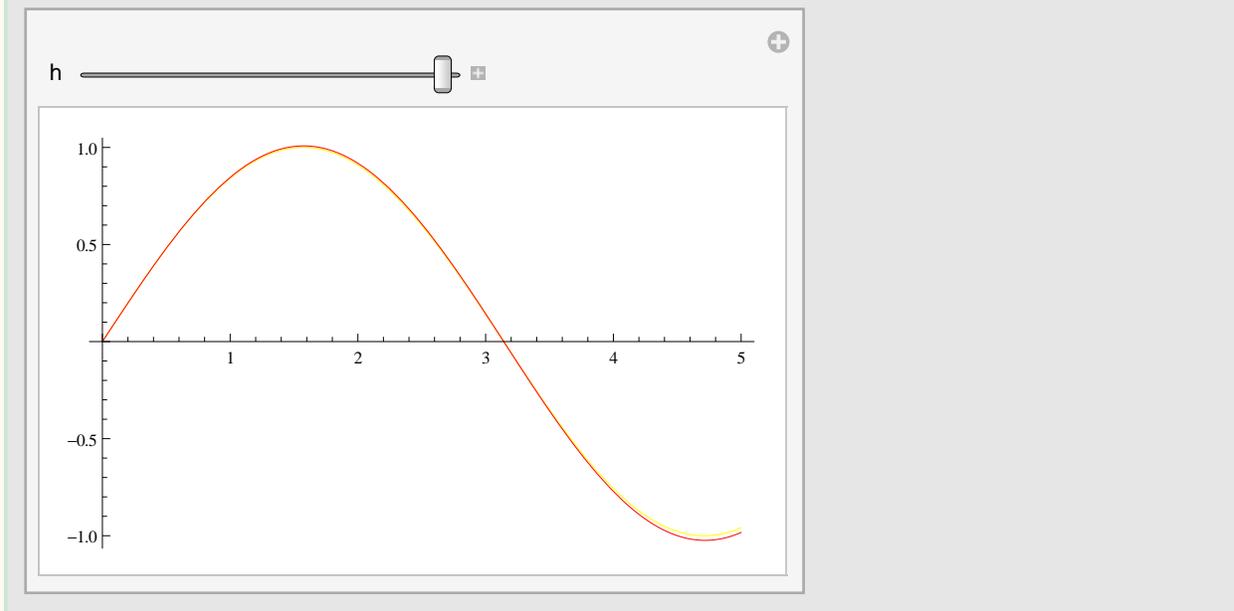
(Debug) (Dialog) Out[237]=

The deformed Exponential

The deformed Trig functions

```
HExp[x_, a_, h_] := (1 + a h) ^ (x / h);
Manipulate[Plot[{Sin[x], Im[HExp[x, I, h]]}, {x, 0, 5}, PlotStyle → {Yellow, Red}], {h, 1, 0.01}]
```
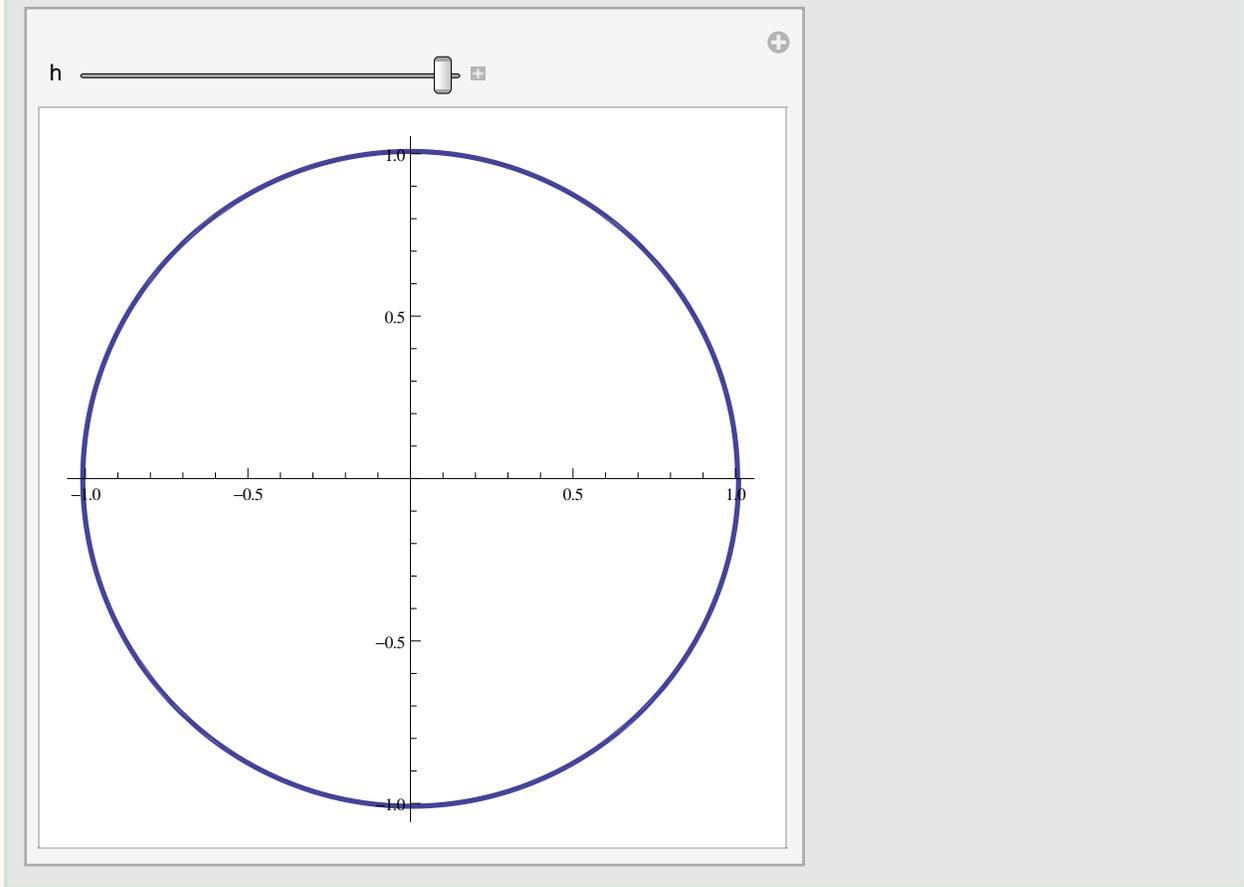
Harmonic Oscillator

(Debug) (Dialog) In[242]:=

```
Manipulate[ParametricPlot[ {Re[HExp[x, I, h]], Im[HExp[x, I, h]]}, {x, 0, 10 Pi}], {h, 0.1, 0.001}]
```

(Debug) (Dialog) Out[242]=

Taylor Theorem

(Debug) (Dialog) In[190]:=

```
f0[x_] := Cos[x ^ 2 / 2]; M = 5;
Di[f_] := Function[m, f[m + 1] - f[m]];
Diff[f_, k_] := Module[{g, h}, h = f; Do[g = Di[h]; h = g, {j, k}]; h];
Pow[x_, n_] := Product[(x - j), {j, 0, n - 1}];
TaylorCoefficients[f_] := Table[g = Diff[f, k]; g[0], {k, 0, M}]
a = TaylorCoefficients[f0];
f1[x_] := Sum[Pow[x, j] a[[j + 1]] / j!, {j, 0, Length[a] - 1}];
S1 = Plot[{f0[x], f1[x]}, {x, 0, 4},
    PlotStyle → {{Thickness[0.01], Blue}, {Thickness[0.01], Green}}, AspectRatio → 1, PlotRange → All];
S2 = Graphics[Table[{Red, PointSize[0.05], Point[{k, f1[k]}]}, {k, 0, M - 1}]];
Show[{S1, S2}]
```

(Debug) (Dialog) Out[199]=
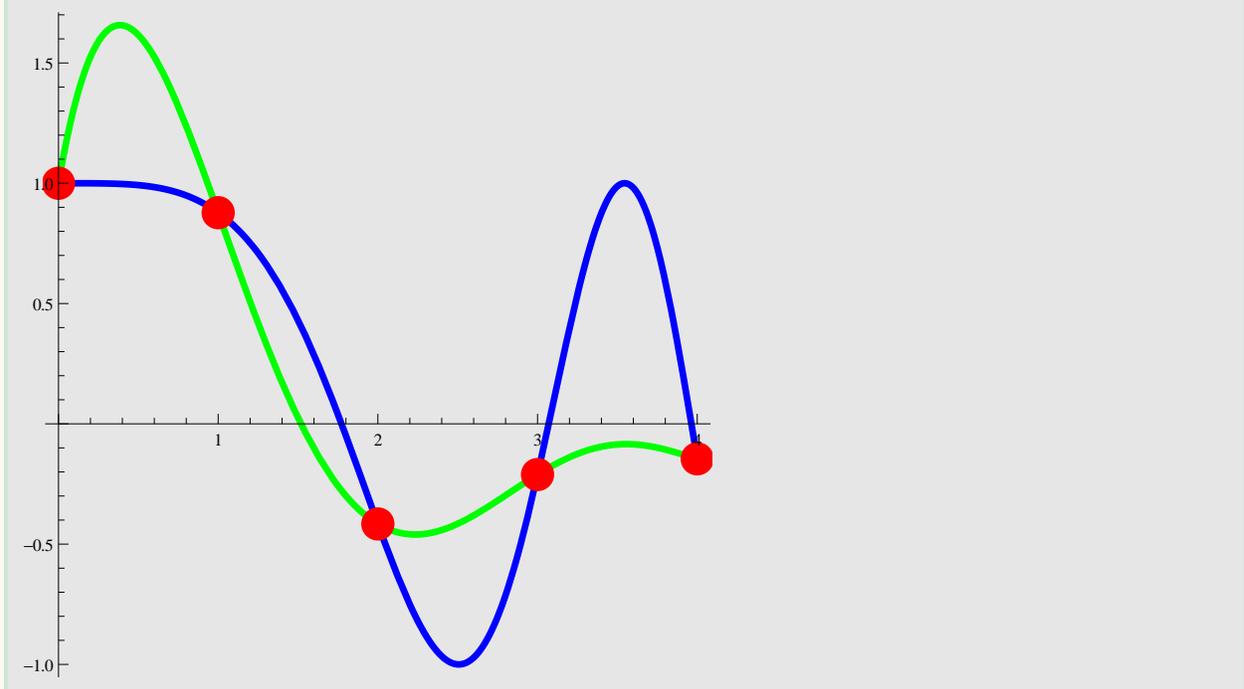
Dow Jones Data fitting

```
c = WolframAlpha["^DJI price history", {{"HistoryDaily:Close:FinancialData", 1}, "TimeSeriesData"},
    PodStates → {"HistoryDaily:Close:FinancialData__All data"}];
DataPoints = Table[{c[[k, 1, 1]], c[[k, 2]]}, {k, Length[c]}];
```

(Debug) (Dialog) In[200]:=

```
A = Table[DataPoints[[i, 2]], {i, Length[c]}];
data = Table[A[[k]], {k, Length[A] - 20, Length[A]}];
M = Length[data]; m[x_] := Max[Min[M, Round[x]], 1];
f0[x_] := data[[m[x]]];
Di[f_] := Function[m, f[m + 1] - f[m]];
Diff[f_, k_] := Module[{g, h}, h = f; Do[g = Di[h]; h = g, {j, k}]; h];
Pow[x_, n_] := Product[(x - j), {j, 0, n - 1}];
TaylorCoefficients[f_] := Table[g = Diff[f, k]; g[0], {k, 0, M}]
a = TaylorCoefficients[f0];
ff[x_] := Sum[Pow[x, j] a[[j + 1]] / j!, {j, 0, Length[a] - 1}];
Plot[{ff[x], f0[x]}, {x, 1, M},
 PlotStyle → {{Thickness[0.005], Red}, {Thickness[0.005], Blue}}, AspectRatio → 1]
```

(Debug) (Dialog) Out[210]=