a) Sprungantwort der realen angepassten 380 kV 4-Bündel-Freileitung nach dem numerischen Talbot-Verfahren

b) Ausschnittsvergrößerung

c) Rechteckimpuls auf der realen angepassten Leitung nach dem numerischen Talbot-Verfahren

jeweils der Graph mit den Lösungspunkten und der Graph als kubischer Spline

```
In[1]:= U = 380*^3;
P = 604*^6;
Z0 = 239;
Z1 = 0.01;
l = 100*^3;
x = 100*^3;
Cs = 14.2*^-12;
Ls = 0.81*^-6;
Rs = 27.3*^-6;
tr = 1*^-7;
Z2 = U^2 / P;
Gs = 17*^-12;
td = x * Sqrt[Ls * Cs];
            Quadratwurzel
Talbot[Fs_, t_, N1_] := Module[{h, shift, ans, theta, k, z, dz},
                                Modul
  h = 2 * Pi / N1;
            Kreiszahl π
  shift = 0;
  ans = 0;
  For[k = 0, k <= N1, k++,
  For-Schleife
    theta = -Pi + (k + 1 / 2) * h;
                Kreiszahl π
```

```
                          ⌊Kreiszahl π
   z = shift + N1 / t * (0.5017 * theta * Cot[0.6407 * theta] - 0.6122 + 0.2645 * I * theta);
                                          ⌊Kotangens                      ⌊imaginäre Einheit I

   dz = N1 / t * (-0.5017 * 0.6407 * theta / Sin[0.6407 * theta]^2 + 0.5017 * Cot[0.6407 * theta] + 0.2645 * I);
                                              ⌊Sinus                      ⌊Kotangens                  ⌊imaginäre Einheit I

   ans = ans + Exp[z * t] * Fs[z] * dz;];
               ⌊Exponentialfunktion

 Re[h / (2 * I * Pi) * ans]]
 ⌊Realteil      ⌊⋯ ⌊Kreiszahl π
```
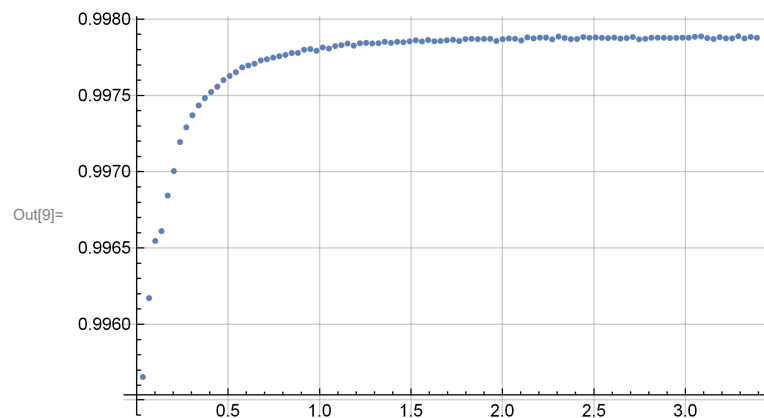
```
lap[p_] := 1 / p * (Z2 * Cosh[Sqrt[(Rs + p * Ls) * (Gs + p * Cs)] * (l - x)] + Z0 * Sinh[Sqrt[(Rs + p * Ls) * (Gs + p * Cs)] * (l - x)]) /
                       ⌊Kos⋯ ⌊Quadratwurzel                                         ⌊Sinu⋯ ⌊Quadratwurzel

    ((Z1 + Z2) * Cosh[Sqrt[(Rs + p * Ls) * (Gs + p * Cs)] * l] + (Z0 + Z1 * Z2 / Z0) * Sinh[Sqrt[(Rs + p * Ls) * (Gs + p * Cs)] * l]);
                 ⌊Kos⋯ ⌊Quadratwurzel                                               ⌊Sinu⋯ ⌊Quadratwurzel

M = 100; Talits = 150; Zeit = 10 000 * td;

Liste = Table[{Zeit / M * i, Talbot[lap, Zeit / M * i, Talits]}, {i, 1, M}];
        ⌊Tabelle

ListPlot[Liste, PlotRange → All, GridLines → Automatic]
⌊listenbezogene Gr⋯ ⌊Koordinatenb⋯ ⌊alle ⌊Gitternetzlinien ⌊automatisch
```
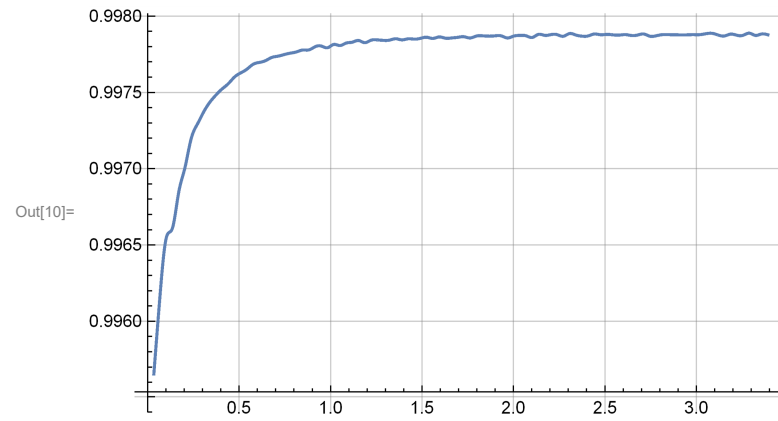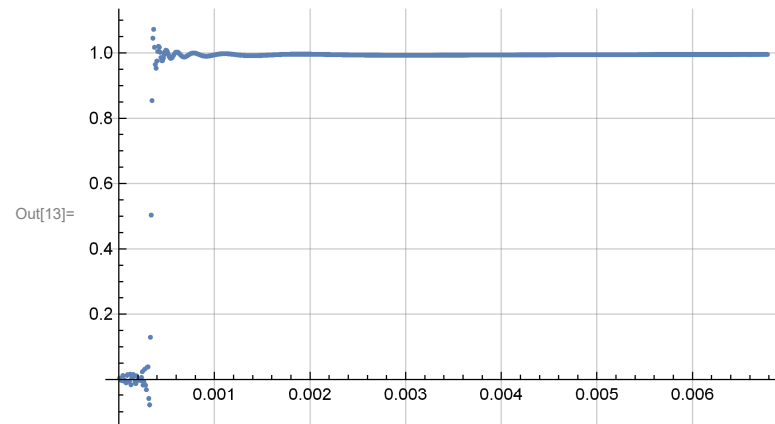
Out[9]=

In[10]:= **ListLinePlot[Liste, InterpolationOrder → 3, PlotRange → All, GridLines → Automatic]**
⌊listenbezogene Liniengra··· ⌊Ordnung der Interpolation   ⌊Koordinatenb··· ⌊alle ⌊Gitternetzlinien ⌊automatisch

Out[10]=

In[11]:= M = 800; Talits = 150; Zeit = 20 * td;

Liste = Table[{Zeit / M * i, Talbot[lap, Zeit / M * i, Talits]}, {i, 1, M}];
　　　　└Tabelle

ListPlot[Liste, PlotRange → All, GridLines → Automatic]
└listenbezogene Gr··· └Koordinatenb··· └alle └Gitternetzlinien └automatisch

··· General: $(3.63499 \times 10^{-8} + 2.03569 \times 10^{-8} i)(-7.84807 \times 10^{-303} - 2.14 \times 10^{-303} i)$ is too small to represent as a normalized machine number; precision may be lost.
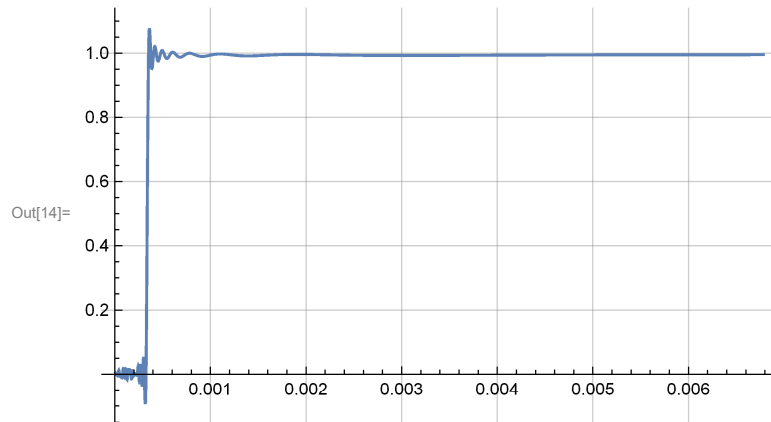
··· General: $(239.073 + 0. i)(-3.36919053959159 \times 10^{-313} - 1.585420764567212 \times 10^{-313} i)$ is too small to represent as a normalized machine number; precision may be lost.

··· General: $(239.073 + 0. i)(-3.36919053959159 \times 10^{-313} + 1.585420764567212 \times 10^{-313} i)$ is too small to represent as a normalized machine number; precision may be lost.

··· General: Further output of General::munfl will be suppressed during this calculation.

Out[13]=

In[14]:= `ListLinePlot[Liste, InterpolationOrder → 3, PlotRange → All, GridLines → Automatic]`

Out[14]=

In[15]:=
```
lap[p_] := U / p * (1 - Exp[-tr * p]) *
  (Z2 * Cosh[Sqrt[(Rs + p * Ls) * (Gs + p * Cs)] * (l - x)] + Z0 * Sinh[Sqrt[(Rs + p * Ls) * (Gs + p * Cs)] * (l - x)]) /
   ((Z1 + Z2) * Cosh[Sqrt[(Rs + p * Ls) * (Gs + p * Cs)] * l] + (Z0 + Z1 * Z2 / Z0) * Sinh[Sqrt[(Rs + p * Ls) * (Gs + p * Cs)] * l]);

M = 800; Talits = 150; Zeit = 10 * td;

Liste = Table[{Zeit / M * i, Talbot[lap, Zeit / M * i, Talits]}, {i, 1, M}];

ListPlot[Liste, PlotRange → All, GridLines → Automatic]

ListLinePlot[Liste, InterpolationOrder → 3, PlotRange → All, GridLines → Automatic]
```

⋯ General: $(239.073 + 0. i) (-3.36919053959159 \times 10^{-313} - 1.585420764567212 \times 10^{-313} i)$ is too small to represent as a normalized machine number; precision may be lost.

⋯ General: $(239.073 + 0. i) (-3.36919053959159 \times 10^{-313} + 1.585420764567212 \times 10^{-313} i)$ is too small to represent as a normalized machine number; precision may be lost.

⋯ General: $(239.073 + 0. i) (-3.35444405280926 \times 10^{-322} + 1.430174565923032 \times 10^{-321} i)$ is too small to represent as a normalized machine number; precision may be lost.

⋯ General: Further output of General::munfl will be suppressed during this calculation.

Out[18]=

Out[19]=