In[1325]:=
```
data = {
    {0, -2.482, -2.521}, {10, -2.266, -2.216}, {20, -1.905, -1.87},
    {30, -1.618, -1.617}, {40, -1.351, -1.358}, {50, -1.122, -1.093},
    {60, -0.874, -0.885}, {70, -0.62, -0.549}, {80, -0.297, -0.299},
    {90, 0.012, 0.019}, {100, 0.302, 0.221}, {110, 0.547, 0.49},
    {120, 0.699, 0.755}, {130, 0.998, 1.022}, {140, 1.265, 1.289},
    {150, 1.58, 1.569}, {160, 1.954, 1.945}, {170, 2.28, 2.248}, {180, 2.59, 2.6}
   };
data = SortBy[data, First];
data[[All, 1]] = data[[All, 1]] - 90;

separated = Join[data[[All, {1, 2}]], data[[All, {1, 3}]]];

angleModelUncond = LinearModelFit[separated, x, x]
angleModelUncond["AdjustedRSquared"]
inverseModelUncond = InverseFunction[angleModelUncond[#θ] &];
Solve[angleModelUncond[θ] == V, θ] // Expand

data[[All, {2, 3}]] = SetAccuracy[data[[All, {2, 3}]], 4];
Grid[data]

image = Show[
   ListPlot[separated],
   Plot[angleModelUncond[θ], {θ, Min[data[[All, 1]]], Max[data[[All, 1]]]}],
   AxesLabel → {"Ângulo (°)", "Tensão elétrica (V)"}
  ];
Export[NotebookDirectory[] <> "/images/Pendulo-fit.pdf", image];

data = {
    {180, 2.91, 2.78}, {170, 2.51, 2.44}, {160, 2.16, 2.18}, {150, 1.82, 1.7},
    {140, 1.47, 1.39}, {130, 1.21, 1.12}, {120, 0.86, 0.85}, {110, 0.622, 0.582},
    {100, 0.37, 0.32}, {90, 0.5, 0.7}, {80, 0.24, 0.25}, {70, -0.54, -0.57},
    {60, -0.82, -0.81}, {50, -1.05, -1.06}, {40, -1.34, -1.37},
    {30, -1.58, -1.57}, {20, -1.98, -1.89}, {10, -2.27, -2.21}, {0, -2.61, -2.57}
   };
data = SortBy[data, First];
data[[All, 1]] = data[[All, 1]] - 90;

separated = Join[data[[All, {1, 2}]], data[[All, {1, 3}]]];

angleModelCond = LinearModelFit[separated, x, x]
inverseModelCond = InverseFunction[angleModelCond[#θ] &];
Solve[angleModelCond[θ] == V, θ] // Expand
angleModelCond["RSquared"]

data[[All, {2, 3}]] = SetAccuracy[data[[All, {2, 3}]], 3];
Grid[data]

image = Show[
   ListPlot[separated],
   Plot[angleModelCond[θ], {θ, Min[data[[All, 1]]], Max[data[[All, 1]]]}],
   AxesLabel → {"Ângulo (°)", "Tensão elétrica (V)"}
  ];
Export[NotebookDirectory[] <> "/images/Pendulo-Condicionado-fit.pdf", image];

data = Import[NotebookDirectory[] <> "../Data/Experimento7.lvm", "TSV"];
data[[All, 2]] = LowpassFilter[data[[All, 2]], 40 / 250];
data[[All, 2]] = Map[inverseModelCond, data[[All, 2]]];
```

```
(* center on zero *)
(*data[[All,2]] = data[[All,2]]-Last[data[[All,2]]];*)
data[[All, 2]] = data[[All, 2]] - Mean[ data[[All, 2]]];

peaks = FindPeaks[data[[All, 2]]][[{8, 9, 10, 11}, All]];
peaksPoints = Table[
  {data[[peaks[[i, 1]], 1]], data[[peaks[[i, 1]], 2]]}, {i, 1, Length[peaks]}]

attenuation = NonlinearModelFit[peaksPoints, β * Exp[α * t - t0], {α, β, t0}, t]

Show[
 ListLinePlot[data, ImageSize → Full, PlotRange → All],
 Plot[90, {θ, Min[data[[All, 1]]], Max[data[[All, 1]]]}],
 ListPlot[peaksPoints],
 Plot[attenuation[t], {t, 0, 10}]
]

fourier = Table[{i, 0}, {i, 0, 250 , 250 / (Length[data] - 1)}];
fourier[[All, 2]] = Abs[Fourier[data[[All, 2]]]];

ListLinePlot[Take[fourier, 8 * 10], PlotRange → All]
Export[NotebookFileName[EvaluationNotebook[]] <> ".pdf",
  EvaluationNotebook[]];
```

Out[1329]= FittedModel[−0.0146842 + 0.027567 x]

Out[1330]= 0.998439

Out[1332]= {{θ → 0.532673 + 36.2752 V}}

Out[1334]=

−90	−2.482	−2.521
−80	−2.266	−2.216
−70	−1.905	−1.870
−60	−1.618	−1.617
−50	−1.351	−1.358
−40	−1.122	−1.093
−30	−0.874	−0.885
−20	−0.620	−0.549
−10	−0.297	−0.299
0	0.012	0.019
10	0.302	0.221
20	0.547	0.490
30	0.699	0.755
40	0.998	1.022
50	1.265	1.289
60	1.580	1.569
70	1.954	1.945
80	2.280	2.248
90	2.590	2.600

Out[1341]= FittedModel[0.124842 + 0.0290542 x]

Out[1343]= {{θ → −4.29687 + 34.4184 V}}

Out[1344]= 0.988743

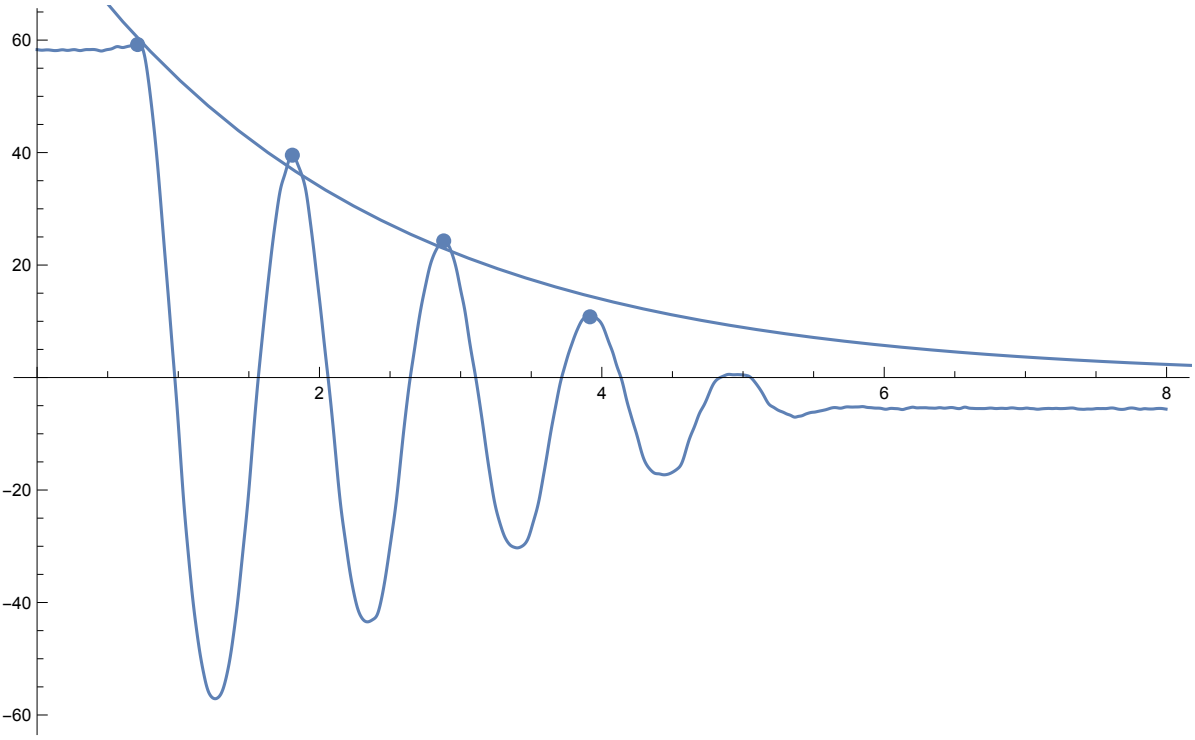
Out[1346]=

−90	−2.61	−2.57
−80	−2.27	−2.21
−70	−1.98	−1.89
−60	−1.58	−1.57
−50	−1.34	−1.37
−40	−1.05	−1.06
−30	−0.82	−0.81
−20	−0.54	−0.57
−10	0.24	0.25
0	0.50	0.70
10	0.37	0.32
20	0.62	0.58
30	0.86	0.85
40	1.21	1.12
50	1.47	1.39
60	1.82	1.70
70	2.16	2.18
80	2.51	2.44
90	2.91	2.78

Out[1354]= {{0.712, 59.2119}, {1.808, 39.537}, {2.88, 24.2938}, {3.916, 10.7998}}

Out[1355]= FittedModel[$4.10123\, e^{3.00736-0.446365\, t}$]

Out[1356]=



Out[1359]=