After determining $\sigma = (y'_0, y'_1, \ldots, y'_n)$ by the method outlined above we can determine with a higher precision the numerical values y_i setting

$$y_i^* = \frac{h}{2} \sum_{0\,j}^{n} a_{ij} y'_j \qquad i = 0,1,\ldots,n$$

3. Numerical results

We have tested the method for the evaluation of the derivatives y'_i $(i = 1,40)$ of some analytical functions $y(x)$ at the points $x_i = ih$ $(i = 1,40)$ for $h = 0{,}05$ starting from a set of approximate values y_i as reported in table I,II,III.

The values y_i^* obtained by the present method are clearly better than the given y'_i s.

The method has been used in order to determine the maximum value of the modulus of the derivative of a function measured experimentally. In every case, we have adopted the smoothing matrix S_2.

Figure 1 shows the experimental values y_i, $i = 1,25$ the accumulated charge in terms of the energy of the quasi Fermi level in a semiconducting crystal in space-charge conditions due to trapping levels, the function (solide line) and the modulus of the derivative (dashed line), calculated by the present method.

The maximum value of the modulus of the derivative y' is connected to the energy position of the trapping level that governs the phenomenon.

The result we obtain agrees with that determined by other methods, [2].

TABLE I

$\lambda = 2.10^{7}$ $\quad$ $y(x) = x^{3}/3$ $\quad$ $\chi^{2} = 38,52$

x_i	$y(x_i)$	y_i	y_i^*	$y'(x_i)$	y'_i
0.05	0.000041	0.000041	0.000041	0.002500	0.002475
0.25	0.005208	0.005156	0.005209	0.062500	0.061252
0.45	0.030375	0.030071	0.030370	0.202500	0.201944
0.65	0.091541	0.090626	0.091522	0.422500	0.422007
0.85	0.204708	0.202661	0.204682	0.722500	0.722012
1.05	0.385875	0.382016	0.385747	1.102500	1.100949
1.25	0.651041	0.644531	0.650644	1.562500	1.561237
1.45	1.016208	1.006046	1.016215	2.102500	2.107910
1.65	1.497375	1.482401	1.499130	2.722500	2.731212
1.85	2.110541	2.089436	2.111794	3.422500	3.399466

(a) We have reported in each table only a few results as the space would be insufficient to report all of them.

Table I reports for the function $y(x) = x^3/3$ the values of the abscissae x_i, of the theoretical ordinates $y(x_i)$, of the experimental ordinates y_i, that differ from the true value by less than 1%, those calculated by the present method y_i^*, the theoretical values of the derivative $y'(x_i)$ and the values of the derivative y'_i obtained by the present method. The value of the Lagrange multiplier and the relative value of χ^2 are also reported.

TABLE II

$\lambda = 10^6$		$y(x) = e^x - x - 1$		$\chi^2 = 39,42$	
x_i	$y(x_i)$	y_i	y_i^*	$y'(x_i)$	y'_i
0.05	0.001271	0.001258	0.001259	0.051271	0.050820
0.25	0.034025	0.033685	0.034045	0.284025	0.281952
0.45	0.118312	0.117129	0.118290	0.568312	0.567674
0.65	0.265540	0.262885	0.265488	0.915540	0.914879
0.85	0.489646	0.484750	0.489543	1.339646	1.338830
1.05	0.807651	0.799574	0.807525	1.857651	1.857131
1.25	1.240342	1.227939	1.240083	2.490342	2.487356
1.45	1.813114	1.794983	1.812066	3.263114	3.258322
1.65	2.556979	2.531410	2.556752	4.206979	4.221641
1.85	3.509819	3.474721	3.513975	5.359819	5.373412

Table II reports the analogous results for the function $y(x) = e^x - x - 1$. For the meaning of symbols see table II.

TABLE III

$\lambda = 4.10^7$ $\qquad$ $y(x) = 1-\cos(x)$ $\qquad$ $\chi^2 = 40$

x_i	$y(x_i)$	y_i	y_i^*	$y'(x_i)$	y'_i
0.05	0.001249	0.001237	0.001241	0.049979	0.049642
0.25	0.031087	0.030776	0.031078	0.247403	0.247244
0.45	0.099552	0.098557	0.099533	0.434965	0.435012
0.65	0.203916	0.201877	0.203869	0.605186	0.605094
0.85	0.340016	0.336616	0.339946	0.751280	0.751536
1.05	0.502428	0.497404	0.502448	0.867423	0.868300
1.25	0.684677	0.677830	0.684731	0.948984	0.948271
1.45	0.879497	0.870702	0.878949	0.992712	0.987785
1.65	1.079120	1.068329	1.077571	0.996865	0.994580
1.85	1.275590	1.262834	1.275774	0.961275	0.986571

Table III reports the analogous results for the function $y(x) = 1-\cos(x)$. For the meaning of symbols see table I.