schdebug

Here we test the function schint:

E=-.5

---------------------------------------------

Outward integration test:
---------------------------------------------

0 nodes

Return value of Psi: 24430075685.431213378906

<table>
<thead>
<tr>
<th>k</th>
<th>r</th>
<th>Psianal</th>
<th>Psiout</th>
<th>Psiout/Psianal</th>
</tr>
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<td>0.000407996702</td>
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<tr>
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<td>0.999973679188</td>
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<td>0.006908178397</td>
<td>0.999982907289</td>
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<tr>
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<td>0.010988337659</td>
<td>0.010988201652</td>
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<tr>
<td>12</td>
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<td>0.016098046701</td>
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<td>0.999990381826</td>
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<td>0.022276981074</td>
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<tr>
<td>k</td>
<td>r</td>
<td>Psianal</td>
<td>Psiout</td>
<td>Psiout/Psianal</td>
</tr>
<tr>
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<td>-----------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>-------------------------</td>
</tr>
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<td>0.000000000000</td>
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<td>inf</td>
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<td>0.000407996702</td>
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</tr>
<tr>
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<td>0.001663891202</td>
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</tr>
<tr>
<td>6</td>
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<td>0.003815148014</td>
<td>1.276775018934e+14</td>
<td>3.34659366841e+16</td>
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<tr>
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<tr>
<td>10</td>
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<td>5.386653813620e+14</td>
<td>3.346153675397e+16</td>
</tr>
</tbody>
</table>

Inward integration test:
Notice that on the inward integration, we don’t quite reach zero; we expect this to improve for greater $N$.

A test of node counting just above the second exited state:

\[ E = -0.05 \]

Outward integration test:

\[ \text{3 nodes} \]
.
.
.

Inward integration test:

\[ \text{3 nodes} \]
.
.
.
Edebug

Searching for the ground state:

E1=-1.0
E2=-.3

Search for energy in range ( -1.0000000000000000, -0.3000000000000000):
N=10

(50 iterations in rtbisp480, func=1.236754e-13)
Solution from rtbisp480: E= -0.4854389178271255
(8 iterations in zriddrp480, fnew=1.581913e-14)
Solution from zriddrp480: E= -0.4854389178271258

Search for energy in range ( -1.0000000000000000, -0.3000000000000000):
N=100

(50 iterations in rtbisp480, func=4.998395e+00)
Solution from rtbisp480: E= -0.4999985397456193
(6 iterations in zriddrp480, fnew=-5.013834e-01)
Solution from zriddrp480: E= -0.4999985397456195

Search for energy in range ( -1.0000000000000000, -0.3000000000000000):
N=1000

(50 iterations in rtbisp480, func=8.859815e+47)
Solution from rtbisp480: E= -0.499999998459483
(13 iterations in zriddrp480, fnew=7.326148e+46)
Solution from zriddrp480: E= -0.499999998459486

Search for energy in range ( -1.0000000000000000, -0.3000000000000000):
N=10000

(50 iterations in rtbisp480, func=-1.080807e+102)
Solution from rtbisp480: E= -0.4999999999999837
(10 iterations in zriddrp480, fnew=-2.095120e-101)
Solution from zriddrp480: E= -0.4999999999999836

Search for energy in range ( -1.0000000000000000, -0.3000000000000000):
N=100000

(50 iterations in rtbisp480, func=-1.507457e+85)
Solution from rtbisp480: E= -0.5000000000000024
(13 iterations in zriddrp480, fnew=3.424516e+84)
Solution from zriddrp480: E= -0.5000000000000030

Searching for the first excited state:

E1=-.2
E2=-.1

Search for energy in range ( -0.2000000000000000, -0.1000000000000000):
N=1000

(47 iterations in rtbisp480, func=-1.916153e+27)
Solution from rtbisp480: E= -0.124999989678650
(7 iterations in zriddrp480, fnew=-2.204524e+25)
Solution from zriddrp480: E= -0.124999989678645
Search for energy in range \((-0.2, -0.1)\):
\(N=10000\)

\(47\) iterations in \(\text{rtbisp480}\), \(\text{func}=9.209434\times10^{133}\)
Solution from \(\text{rtbisp480}\): \(E = -0.1249999999999977\)

\(8\) iterations in \(\text{zriddrp480}\), \(\text{fnew}=5.570422\times10^{132}\)
Solution from \(\text{zriddrp480}\): \(E = -0.1249999999999974\)

Second excited state:
\(E_1=-.1\)
\(E_2=-.05\)

Search for energy in range \((-0.1, -0.05)\):
\(N=1000\)

\(46\) iterations in \(\text{rtbisp480}\), \(\text{func}=-8.138717\times10^{17}\)
Solution from \(\text{rtbisp480}\): \(E = -0.0555555382690919\)

\(8\) iterations in \(\text{zriddrp480}\), \(\text{fnew}=1.236101\times10^{16}\)
Solution from \(\text{zriddrp480}\): \(E = -0.0555555382690926\)

Search for energy in range \((-0.1, -0.05)\):
\(N=10000\)

\(46\) iterations in \(\text{rtbisp480}\), \(\text{func}=-3.419517\times10^{103}\)
Solution from \(\text{rtbisp480}\): \(E = -0.0555555555538426\)

\(8\) iterations in \(\text{zriddrp480}\), \(\text{fnew}=-1.287723\times10^{102}\)
Solution from \(\text{zriddrp480}\): \(E = -0.0555555555538427\)

How many more can we get?
Note that Ridder's method is spectacularly better than bisection; see NR for a precise notion of 'better'.

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