january 21/02

Dear Volodya

of course I do agree. I'm speaking about something else.

1)My program has been written for coefficients A_n and B_n. I integrated ordinary differential equations for them, starting from the initial conditions $A_n(0)$, $B_n(0)$. So I have, for any time, $A_n(t)$ and $B_n(t)$. Agree?

2) In order to represent wave function in z-coordinate I have to make the transformation

$$\begin{aligned} \psi_1(z,t) &= \textstyle\sum_n u_n(z) A_n(t) \\ \psi_2(z,t) &= \textstyle\sum_n u_n(z) B_n(t) \end{aligned} \tag{1}$$

where $u_n(z)$ is the oscillator basis. Agree?

3) If you have $\psi_i(z,t)$ and you want to compute the coefficients $A_n(t)$ and $B_n(t)$ you need to make the inverse transformation of Eq.(1) :

$$\begin{aligned} A_n(t) &=< u_n|\psi_1(t) > \\ B_n(t) &=< u_n|\psi_2(t) > \end{aligned} \tag{2}$$

where $< ... >$ means the integral over dz . Agree?

4) Well, what I'm trying to tell you is that if you apply in sequence Eq.(1) and Eq.(2) you did't get the identity because of numerical errors. You cannot invert exactly!

Now, suppose you cut at some time τ in z-space the wave function

$$\psi_1(z,\tau) = \psi_1^{left}(z,\tau) + \psi_1^{right}(z,\tau)$$

and

$$\psi_2(z,\tau) = \psi_2^{left}(z,\tau) + \psi_2^{right}(z,\tau)$$

and compute the new coefficients

$$
\begin{aligned}
A_n^{left} &=< u_n|\psi_1^{left} > \\
A_n^{right} &=< u_n|\psi_1^{right} > \\
B_n^{left} &=< u_n|\psi_2^{left} > \\
B_n^{right} &=< u_n|\psi_2^{right} >
\end{aligned} \tag{3}
$$

Normalize them to 1 and compute back, using Eq.(1) the wave functions

$$
\begin{aligned}
\phi_1^{left} &= \sum_n A_n^{left} u_n \\
\phi_1^{right} &= \sum_n A_n^{right} u_n \\
\phi_2^{left} &= \sum_n B_n^{left} u_n \\
\phi_2^{right} &= \sum_n B_n^{right} u_n
\end{aligned} \tag{4}
$$

you do not get ψ_1^{left}, ψ_1^{right}, ψ_2^{left}, ψ_2^{right}

As an example I plot in figure (1), the real part of ψ_1^{left} (black) and the real part of ϕ_1^{left} (red), after killing of big peak. As you can see the wave are slightly shifted namely the coefficients A_n are slightly different.

FIGURES

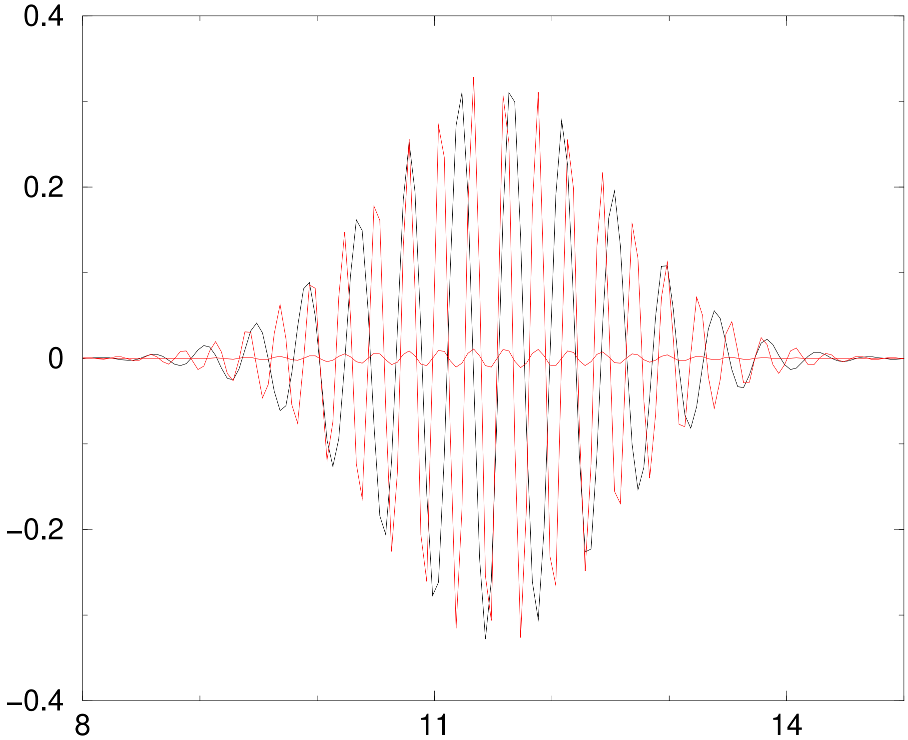

FIG. 1. Real part of wave function correspondent to spin up before killing (red) and after killing (black) computed with the new coefficients. Red curve has been normalized.

On the other side one can think about killing directly the coefficients A_n and B_n.

If you look at them in n space for the two separate peaks, they look like quite different, see Fig.(2).

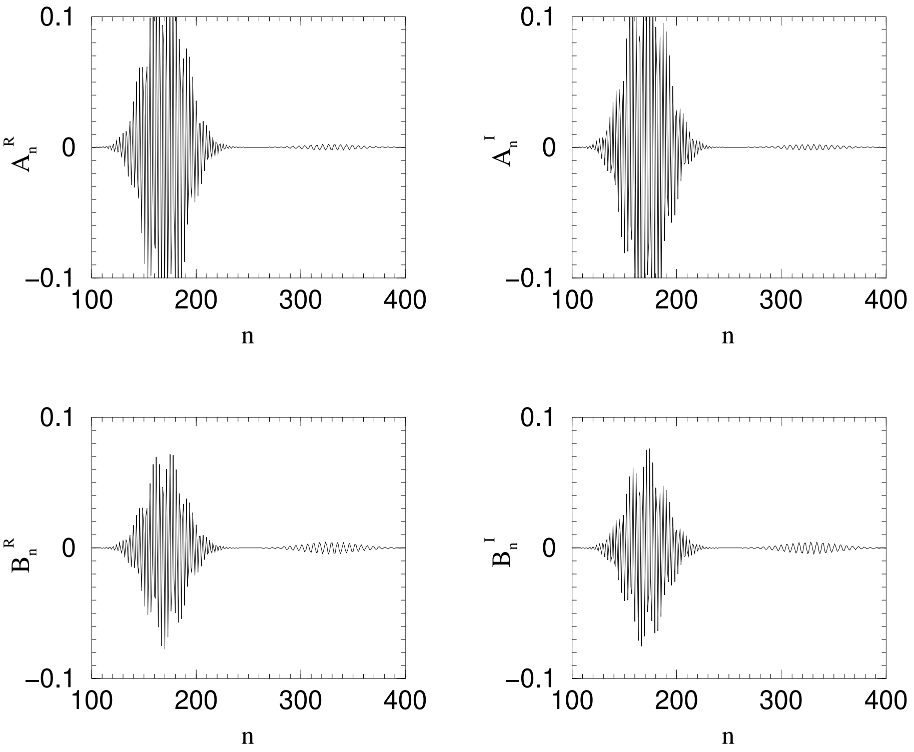

FIG. 2. Coefficients A_n and B_n real and imaginary parts before killing.

But if you look into details, see Fig.(3) you do not know where operate the cut. In any case the wave function obtained from the left part of coefficients only will be different from the left part of the wave function obtained from all coefficients and this is because of interference.

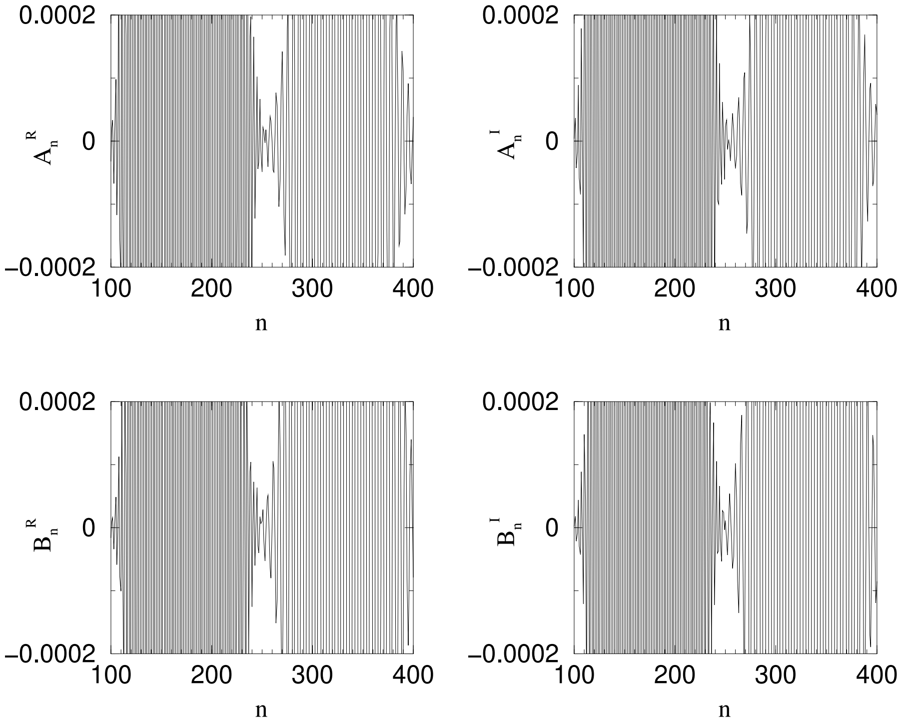

FIG. 3. Coefficients A_n and B_n real and imaginary parts before killing (the same as figure (2) but enlarged to a smaller scale.

Hope you understand my point.

yours, Fausto