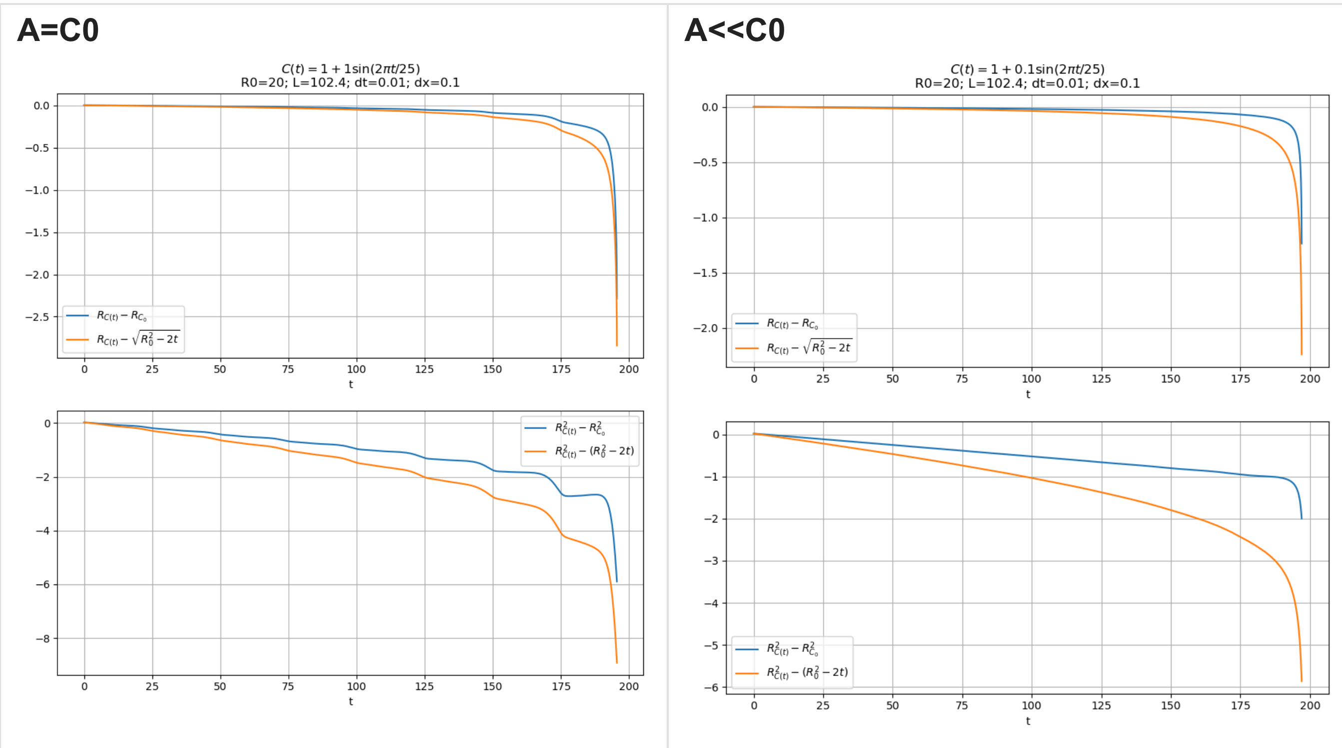
2D Slow oscillations (A<<C0) (Numerical)

Steps

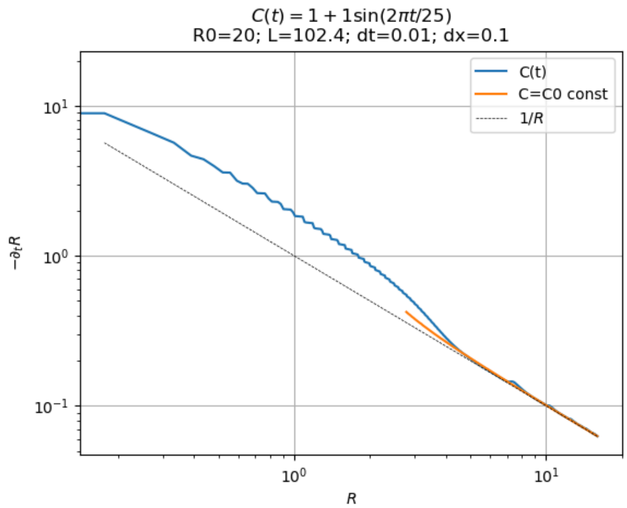
If $A = C_0$ (the oscillation is positive and touching zero) we can see steps, as in the case where the oscillation is negative ($A \gg C_0$).
But for very small amplitude (the oscillation is positive and **far from zero**) we do not see any steps. We see that the decay of the radius is faster.



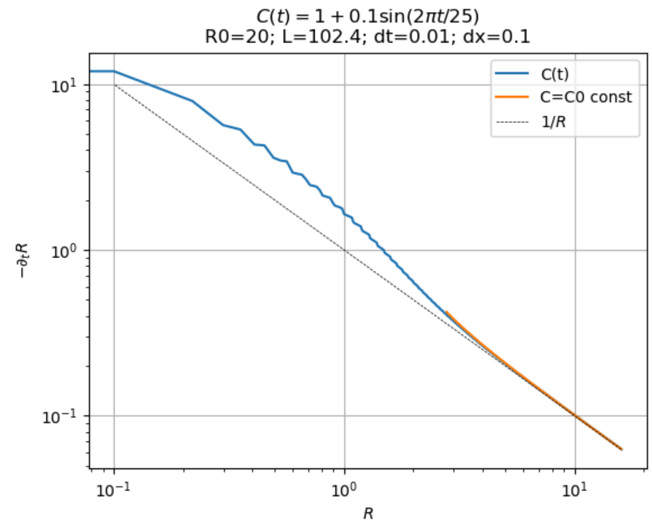
Microscopic derivative

It is defined as $\partial_t R = \frac{\delta R}{dt}$ where δR is the variation of R over the time-step dt. We can see (small) step-like features at large R for $A = C_0$.

A=C0

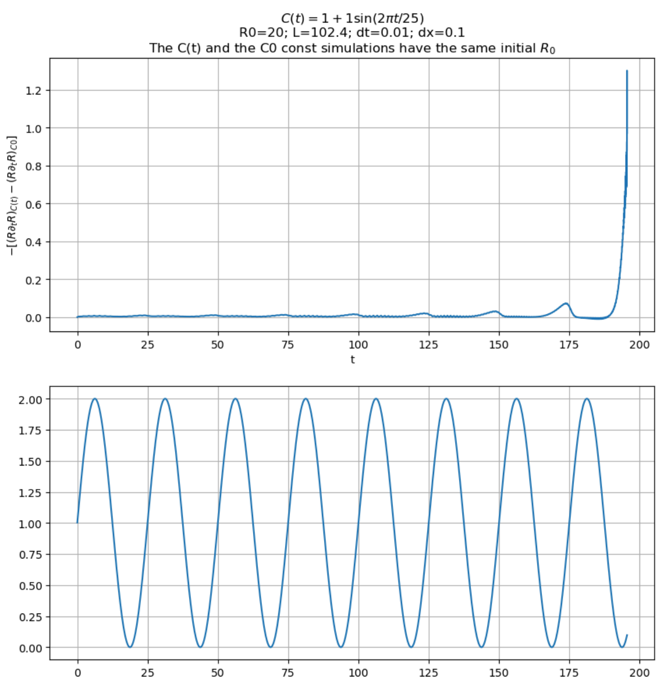


A<<C0

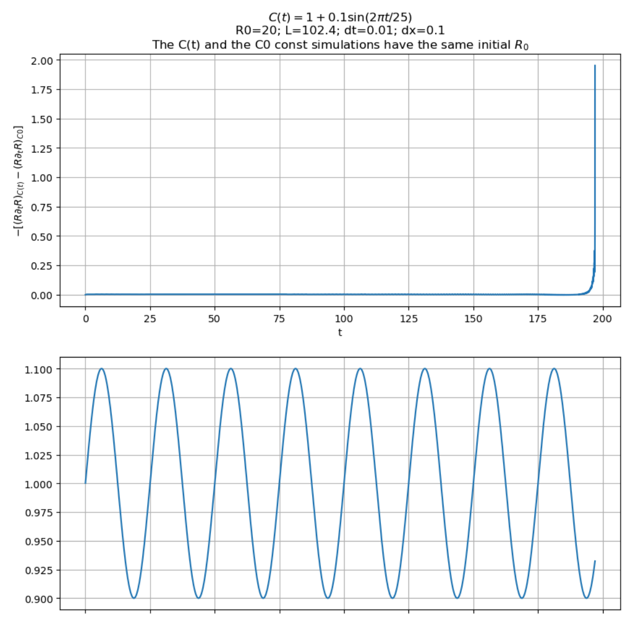


Then we can consider $R\partial_t R$ that is expected to be constant if MBC is true.
When $A = C_0$, like in the $A \gg C_0$ case, we see periodic features. Here the quantity does **not oscillate, but it keeps the same sign**. This is coherent with steps in $R(t)$.

A=C0 (steps evidence)

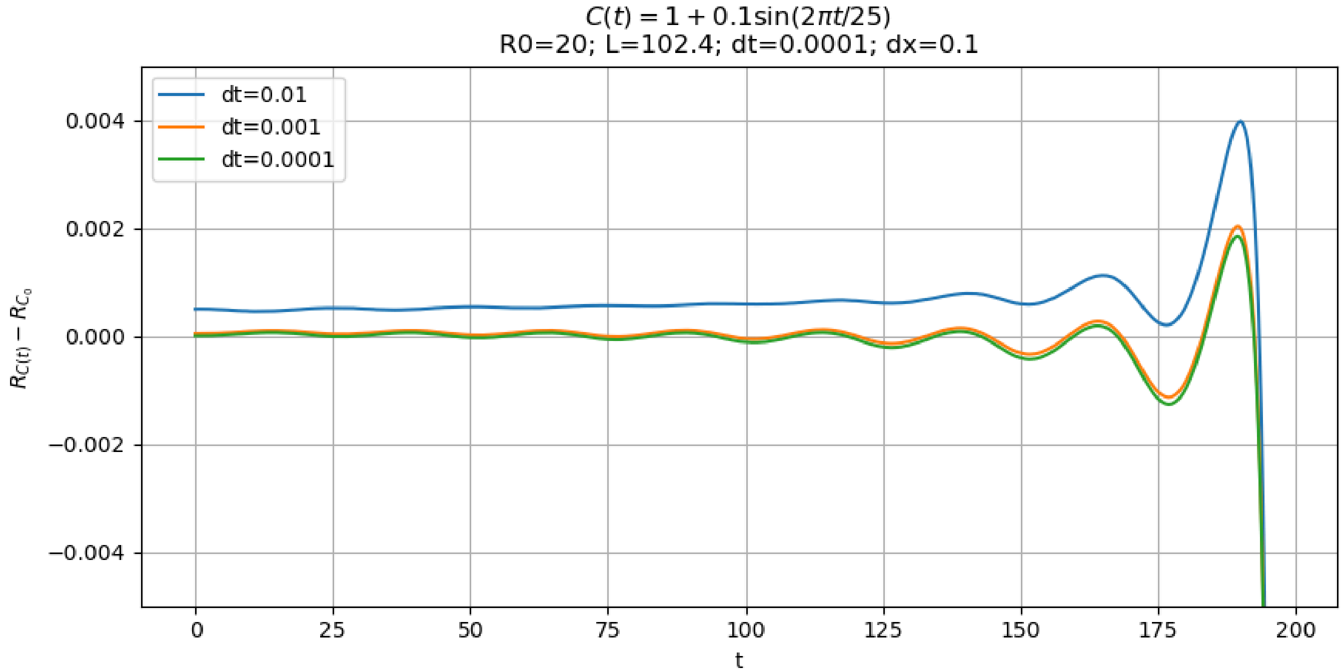


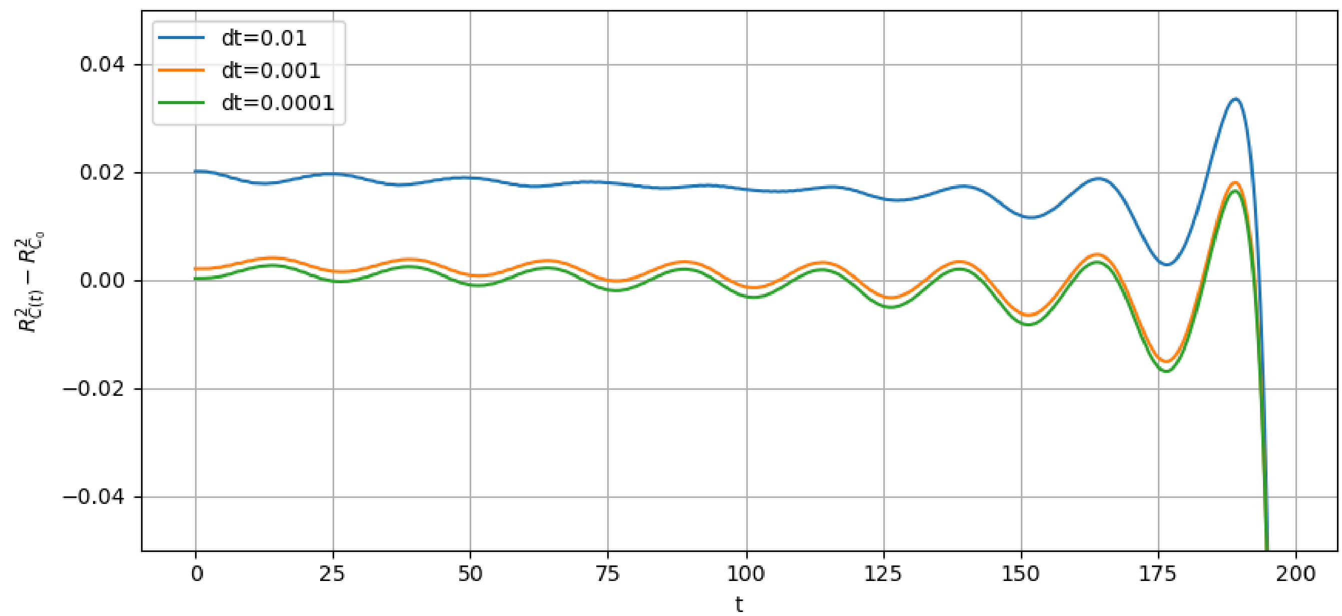
A<<C0 (no steps)



Oscillations of $R(t)$

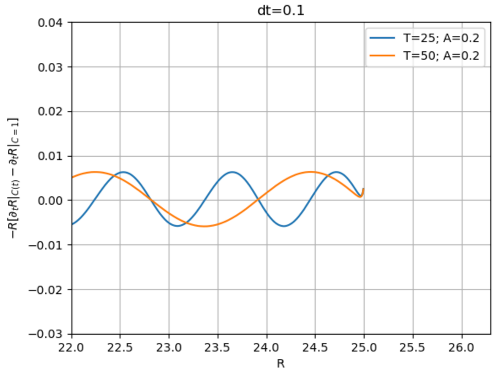
We see oscillations of $R(t)$ as a function of time, that do not vanish if $dt \to 0$.

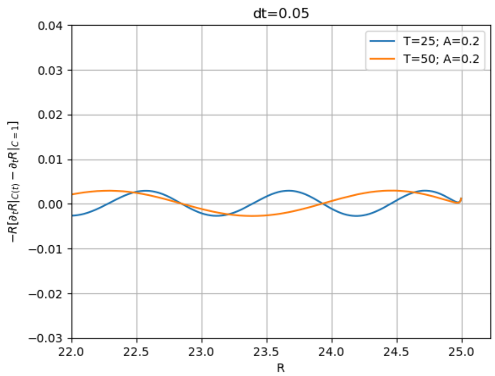


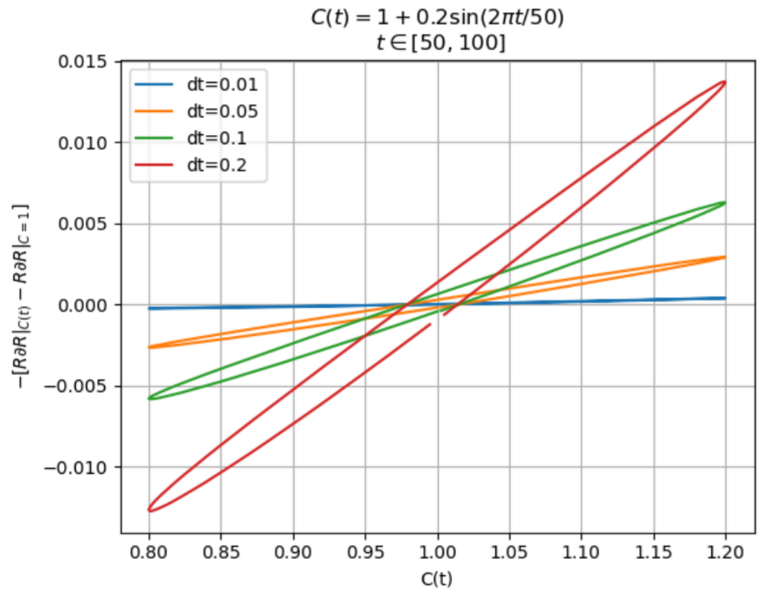


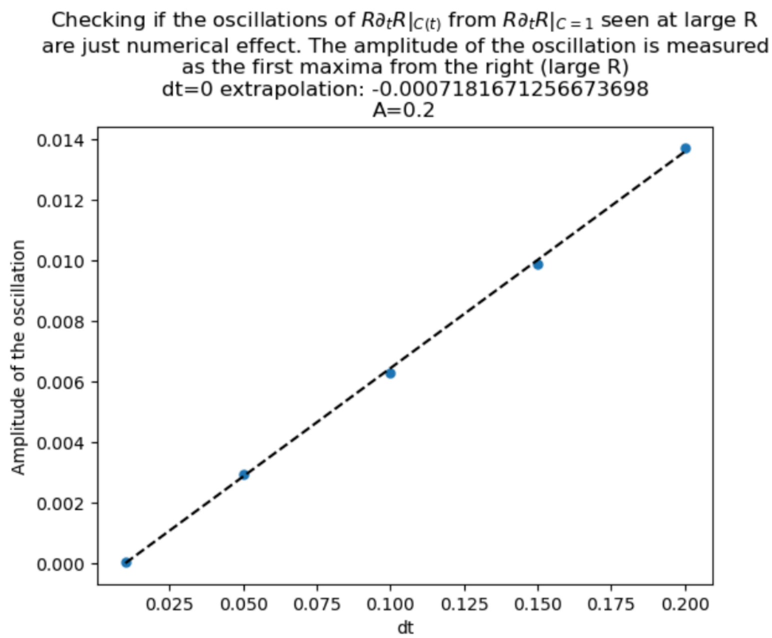
Is this coherent with Previous observations?

In the past, we observed oscillations of $-[(R\partial_t R)_{C(t)} - (R\partial_t R)_{C_0}]$ with time when $A \ll C_0$. It was shown that their amplitude decreases when dt decreases. But the smaller value of dt used in the past simulations is the higher used in the ones above. So we cannot say they are not compatible.



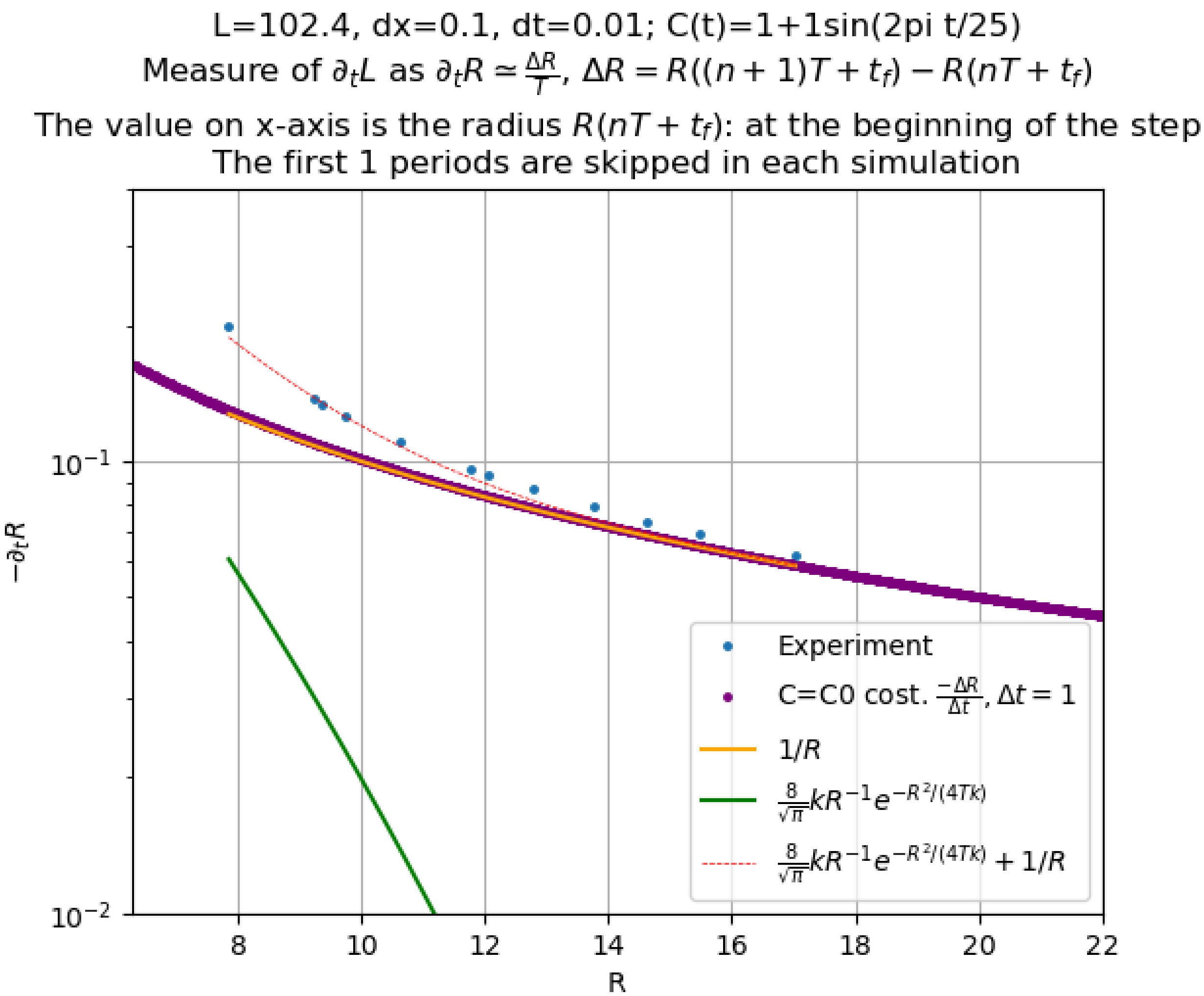






Macroscopic derivative

We can define a macroscopic derivative $\partial_t = \frac{\Delta R_{step}}{T}$ where ΔR_{step} is the variation of the radius along a window of time that fully contains a step.
In the limit where $A \gg C_0$ we have a formula for the end of the step t_f. Even if $A = C_0$ does not correspond to this limit, **we can try** to use the same formula and measure the variation of R over $nT + t_f \to (n+1)T + tf$.

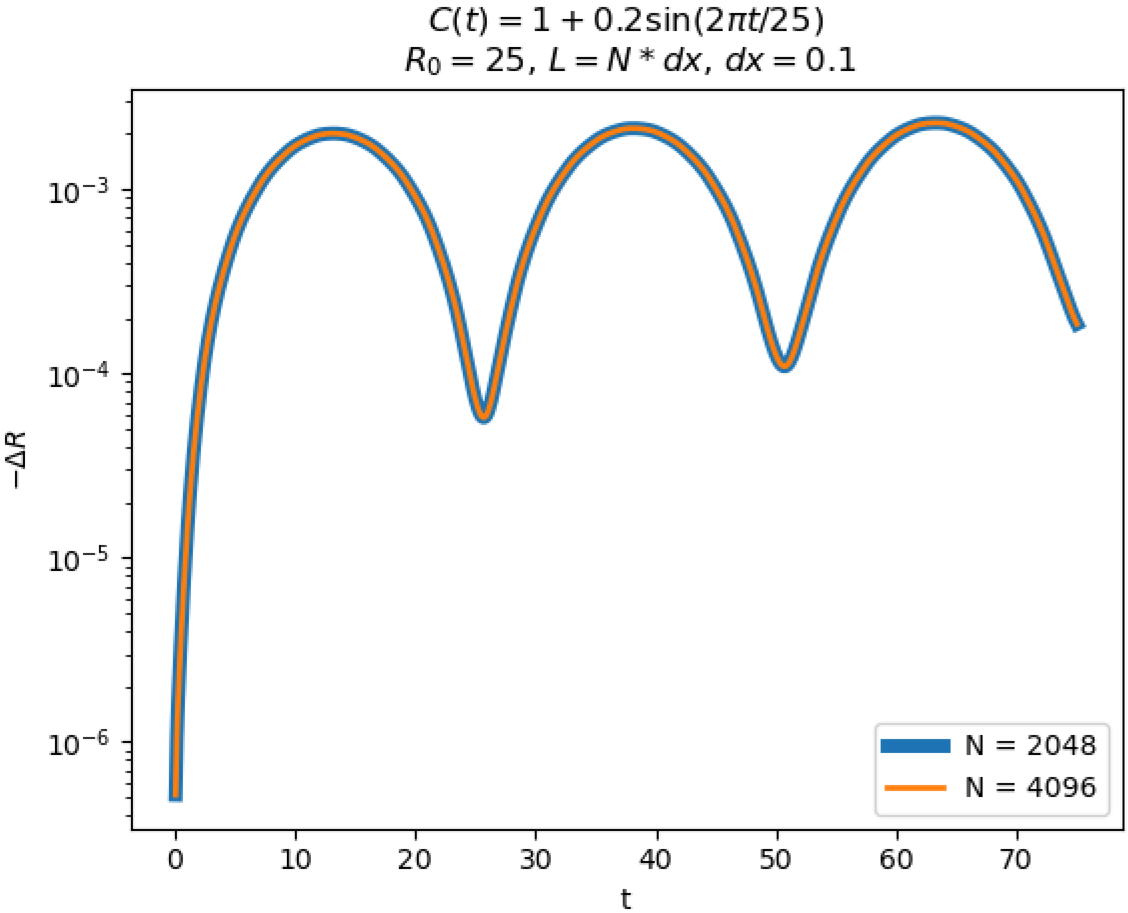


Surprisingly, the **sum** of the coarsening law found in the linear dyn with erf-shaped kinks model and the law of kink dynamics works very well. But I have no explaination, because we're not in the limit $A \gg C_0$ where I developed the model giving the green line coarsening law.

For the case $A \ll C_0$ there are no steps, the formula for t_f (as we found it in the limit $A \gg C_0$) does not make sense and so there is no point in computing a macroscopic derivative.

Simulation box effect

The size of the box, as soon as $Ndx \gg 4R$, it does not affect the dynamics of $R_{C(t)}(t) - R_{C=C_0}(t)$.



$C(t) = 1 + 0.2\sin(2\pi t/25)$
$R_0 = 25$, $L = N * dx$, $dx = 0.1$
10^{-3}
10^{-4}
10^{-5}
10^{-6}
$-\Delta R$
N = 2048
N = 4096
0
10
20
30
40
50
60
70
t