Review report of JPhysA-117843

In an earlier work (Ref. [13]) of the same author, the spatially extended SIR model was used to show that the spread of COVID-19 is essentially quadratic and peripheral in nature. The coefficient of the quadratic growth increases as the disease invades new countries. In this work, the same model is extended with the possibility of reinfection. Interestingly, reinfection of the recovered individuals slows down the growth rate. The reason behind this is that the reinfections help to merge previously isolated outbreak hotspots. This reduces the circumference of the infected zone and thereby the rate of spread, which remains quadratic with a smaller coefficient.

In my opinion, the study is interesting, clear, and concisely written and should be published in J. Phys. A: Math. Theor. Before that, I have some minor points and queries.

1. In this model, the recovered individuals get reinfected with a probability γ. It appears more logical that a recovered individual first becomes susceptible and then gets reinfected. The SIRS model captures this possibility. Is there any reason behind reinfecting a recovered person directly? Do these two models produce similar results? If this is the case, the author should mention it. If not, the direct reinfections ($R \to I$) should be justified.

2. The values of μ and γ used to generate Figure 3 should be mentioned in the caption.

3. The value(s) of t used for Figure 5(a), 5(b), and 5(c) should be mentioned in the caption.

4. The case of $\mu = 0.1$ and $\gamma = 0.1$ may be discussed a little more. The curve (c) of Figure 6 shows that the spread continues due to reinfections (unlike curve (a) with $\gamma = 0$). However, Figure 5(c) seems to indicate otherwise. The straight line portions of the curves (a) and (c) of Figure 6 are almost parallel even though they have very different values of μ. A discussion on this point could further demonstrate the impact of reinfections.