A re-examination of the role of friction in the original Social Force Model

Reviewer

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The paper studies the impact of the friction parameter in the original SFM.

At first I thought this is a work concerned with the calibration of a parameter in an old model for a special case: corridors. This sounds very specific and not so overwhelmingly interesting, right? However, I think this paper contains some nice ideas and results that are certainly interesting for the community if written and presented adequately. In my opinion the very best part of the paper comes in the last 2/3 of the manuscript. Only here, the paper starts to show interesting analysis and results, I would describe as original. I think the authors would be better off focusing more on the content in Appendix A and B. This nice normalization, is good. from there work with Eq. (A.3) and go on with the clustering analysis. The analysis shown in Fig. 6 is also interesting. Here, I wish the authors could shed more light on the famous boundary effects, so controversially discussed in the literature.

Here are some specific comments to the text:

- Reading the introduction, I believe the authors know very good the works done by Helbing and some of his co-authors, especially Johansson. Most of the references in the text are citing these two (Ref. 2 most of all). I believe, it would be good to broaden a bit the literature review in the introduction to more recent works as well. At last, during the last 10 years some positive development in the community could be observed, right?

- I also suggest to reduce the obvious enthusiasm of the authors and dispense with the use of superlatives like "a wonderful summary" or "a seminal work" (repeated many times). By the way, Ref. 16 is from

2007. A more recent review of empirical data can be found here doi : $10.1007/978 - 3 - 642 - 27737 - 5\_706 - 1$ " Empirical Results of Pedestrian and Evacuation Dynamics"

- The very first paragraph in the paper is not quite accurate in my opinion. The force social force model ever presented was published in K. Hirai and K.Tarui in 1975 (a simulation of the behavior of a crowd in panic, Proc. of the 1975 International Conference on Cybernetics and Society. (1975) 409–411). The model was not called SFM, but it is a force-model that "nicely bridges the socio-psychology with Newtonian dynamics".
- It is not clear to me why the SFM explains why the faster-is-slower effect happens. It can be produces, yes, but it does not explain **why**. Please clarify or reformulate.
- In general the authors write "Helbing and co-workers". I suggest to use the more formal et al. This is also more necessary in the references. There sometimes the authors use all names of the authors and sometimes only the first author followed by et al. Please also check some errors in some names (K\"oster, L\"ohner, . . .)
- Equations are missing punctuation.
- Section 3: Why is the length of the corridor L=28m while the width is w=40m. This sounds strange and I'm not sure if it is necessary to have some big values for w.
- Section 3: Why are the details about the implementation (C++, LAMMPS) necessary? I think unless the authors are intending to open-source their code (which would be nice by the way) there is no need to mention these details. Also the authors mention a LAMMPS built in function calculating the clusters. What is this function?
- Section 4: Here the authors cite a lot of other works, especially from 2 and 36, but they do not give their **own** opinion, in regard of the new findings. Again just a reminder Ref 2 is 10 years old. For new findings see Loehner PED 2016 in Hefei.
- Page 10: v_d is the desired speed not the "anxiety level".
- Page 14: "In our case, pedestrians near the walls are the ones with the lower velocity". Is this a know empirical fact? Why is it so? Maybe the authors could explain more this phenomenon.

- I think Fig. 4 and 5 can be safely removed and just replaced with Fig. 6. The normalisation here is nice.
- The interesting phenomenon the authors show in page 23 was not well analysed and explained. Why is it for high κ pedestrians stick together more? Intuitively I would think that high κ means high repulsive forces which means that pedestrians stay away from each other not other way around.
- In Appendix A the two Parameters in Eq. A.3 are not discussed. Instead the focus is still on τ and κ. How is this good? Why do you normalise the model, come up with two parameters only then to continue discussing the parameters in the un-normalized model?

To summarize, I think this paper can be published. However, some heavy restructuring and deeper analysis on the points of interests may be necessary.