A Kinetic Model for Pedestrian Evacuation in a Corridor with an Aggressive Sparse Countercurrent [†]

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The modeling of pedestrian flow is a relevant topic which can lead to valuable information for urban planning as well as for improving evacuation strategies. Most works in this field include a heavy numerical component while theoretical predictions are scarce. In the present work we propose a simple yet rich model for bidirectional pedestrian flow in a one dimensional evacuation scenario where a dense crowd of passive walkers exit the building while a sparse group of aggressive individuals attempt to re-enter. The model is based on a kinetic theory treatment with Boltzmann-like equations considering a two moment approach for the transport equations. The corresponding system in linearly analyzed in order to identify stability regions where the flow towards the exit is uninterrupted provided the countercurrent is aggressive enough. The criterion for the onset of a congestion, and thus the relevant parameters in order to avoid it, are obtained in a purely analytical fashion based on statistical physics.