Pedestrian Dynamics in Jamology

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Abstract

In this talk, the achievements of research on pedestrian dynamics in Jamology are summarized. The speaker mainly focus on four situations, i.e., one-dimensional unidirectional flow, bidirectional flow, egress process and queuing process. Cellular-automaton models as well as prescription of easing jam in these situations are presented.

Keyword: Jamology, Pedestrian dynamics, Evacuation, Queue, Cellular automaton

"Jamology" is an interdisciplinary study on self-driven particles such as vehicles, pedestrians, ants, molecular motors and many others. It has characteristics of both physics and engineering. Its goal is not only elucidation of collective phenomena of self-drive particles, but also development of solutions for jam, which disrupts smooth flow.

Dynamics of pedestrians, which has been vigorously studied in traffic engineering, architecture and psychology, is also one of the main research topic in Jamology. Pedestrians (self-drive particles) do not obey the law of action and reaction; therefore, Newtonian mechanics does not work effectively. Moreover, it is almost impossible to predict the movement of individual pedestrian in detail since she has own will. In spite of these difficulties, researchers have developed new theories and models, and studied macroscopic collective behaviors of pedestrians when the destination of pedestrians is clear. Some solutions for ease congestion (jam) are also considered.

In this talk, the speaker summarizes the achievements of research on one-dimensional unidirectional flow, bidirectional flow, evacuation (egress) process and queuing process. In congested unidirectional flow, slow rhythm improves pedestrian flow [1]. In bidirectional flow, moderate anticipation smooth the flow, while excessive anticipation hinders it [2]. In egress process, it is indicated that non-competitive behavior and an appropriately set obstacle may increase the flow when the width of exit is small [3, 4]. It is also revealed that diminution of local flow enhance the total flow at the exit in the case there are successive bottlenecks [5]. In queuing process, the effects of excluded volume and walking distance, which are necessary for modeling pedestrians, are introduced to the original model. Our extended model succeeds to suggest a suitable type of queuing system as a function of the parameters in queuing systems [6].

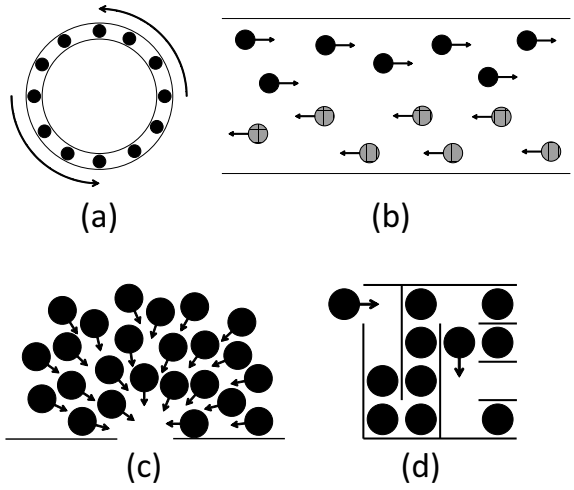

Figure1: Schematic views of various situations. (a) One-dimensional periodic unidirectional flow. (b) Bidirectional flow. (c) Egress process. (d) Queuing process.

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