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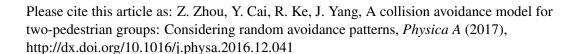
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A collision avoidance model for two-pedestrian groups: considering random avoidance patterns

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ABSTRACT

Grouping is a common phenomenon in pedestrian crowds and group modeling is still an open challenging problem. When grouping pedestrians avoid each other, different patterns can be observed. Pedestrians can keep close with group members and avoid other groups in cluster. Also, they can avoid other groups separately. Considering this randomness in avoidance patterns, we propose a collision avoidance model for two-pedestrian groups. In our model, the avoidance model is proposed based on velocity obstacle method at first. Then grouping model is established using Distance constrained line (DCL), by transforming DCL into the framework of velocity obstacle, the avoidance model and grouping model are successfully put into one unified calculation structure. Within this structure, an algorithm is developed to solve the problem when solutions of the two models conflict with each other. Two groups of bidirectional pedestrian experiments are designed to verify the model. The accuracy of avoidance behavior and grouping behavior is validated in the microscopic level, while the lane formation phenomenon and fundamental diagrams is validated in the macroscopic level. The experiments results show our model is convincing and has a good expansibility to describe three or more pedestrian groups.

Keywords: Traffic engineering, Pedestrian grouping behavior, Velocity obstacle, Collision avoidance model

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