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Review of PhD Thesis by Marek Bukáček

Ing. Marek Bukáček a graduate student at the Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University in Prague, study branch Mathematical Engineering, has prepared PhD thesis titled "***Role of data representation in modeling of pedestrian flow***". According to the letter from Prof. Igor Jex the Dean of Faculty of Nuclear Physical Engineering Ref. No .: 7 O29-V 1/21/1 4920 / Záb. I present my opinion on this dissertation taking into account different aspects pointed out in the letter.

How much the topic of the thesis is up to date:

The dissertation refers to microscopic models of crowd dynamics. The author proposes to develop the methodology of microscopic models by proposing a mechanism of new types of potential fields that are useful in people's navigation. In recent years, due to the development of computing technologies and the available computing power, microscopic models of the crowd are gaining more and more importance. This work is part of the contemporary trend of the crowd dynamics research community, which takes into account the decision-making process of individuals.
Taking into account the substantive content of the work, I believe that the topic of the work has been defined correctly, in line with the current trends in science.

What are the methods applied in the thesis,

In the work, the author uses a number of methods for conducting research on crowd dynamics. The first method is to observe crowd phenomena and analyse these phenomena under physical theories such as phase transition. This allowed for the formulation of new models of people flow using potential

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fields and the heterogeneity of individual behaviour. Then, a series of people flow experiments under different circumstances were carried out: evacuation of the train, the flow of people in the building through the layout of the rooms, etc. Another point was to compare the simulation results of the proposed models with reality and other crowd models, in particular the Social Distances Model. In my opinion, the applied research methods are correct and I assess them positively.

Whether the goal of the thesis has been achieved,

One of the main objectives of the work was to propose and test microscopic crowd models that take into account the individual behaviour of pedestrians. The correct sequence of research was maintained. The proposed model was confronted with reality: the necessary procedures related to calibration, verification and validation of the model were performed. The computer simulations and the analysis of results described in chapter 6 were carried out correctly. Taking into account all the research work, I believe that the goals of the work have been achieved.

What is the scientific value of the results,

The assessed work includes a description of a new model of pedestrian dynamics as well as an analysis of a number of tests performed. One can point out many recent microscopic models around the world, but in this case the author proposed a unique model based on phase transitions, floor fields and individual human behavior. The conducted experiments are an important factor distinguishing the work. The author approached the work with full responsibility, as all theoretical considerations were supported by multi-stage verification and validation. In my opinion, the work presents a number of valuable scientific results and my opinion on this point is unequivocally positive.

What is overall evaluation on the thesis,

The work is written in accordance with all scientific standards, the diligence of the work language and high editorial standard also deserve attention. The author has been creating the work for many years and it is a well-thought-out work. The first experiments were conducted in 2012 (Table 1.1. p. 16).

In a dissertation of 180 pages, there are fragments that could be otherwise formulated/improved: chapter 1.4 does not show much connection with the topic of the thesis (it contains additional activities), some figures e.g. 2.17, 2.18, 3.37, 3.38 could be more legible. Minor editing errors may be indicated in the dissertation e.g. pp. 48, 53 and so on, however they do not significantly impede the reception of the work.

In my opinion, the assessed doctoral dissertation is written in compliance with all scientific standards and contains valuable results. I strongly recommend it for presentation and public defence - further steps in the doctoral procedure.

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