Computer Models
For
Fire and Smoke

Model Name:	Generalized Social Distances
Version:	2.3
Date:	11.02.2014
Model Actively Supported?:	Yes
Classification:	Egress model->Agent-based model/Cellular Automata
Very Short Description:	Computes movement times of evacuation from large facilities like stadiums, multi-storey buildings on the base of microscopic, Agent-based simulation using Cellular Automata (CA).
Modeler(s), Organization(s):	Dr Jarosław Wąs, Mr Robert Lubaś, - AGH University of Science and Technology, Poland
User's Guide:	Manual of Generalized Social Distances
Technical References:	- Wąs Jarosław, Lubaś Robert, *Adapting Social Distances Model for Mass Evacuation Simulation* Journal of Cellular Automata, Old City Publishing 2013, Vol. 8, Issue 5/6, pp. 395 – 405 - Wąs Jarosław, Gudowski B., Matuszyk P.J.: *Social Distances Model of Pedestrian Dynamics*. International Conference of Cellular Automata in Research and Development 2006, Berlin - Heidelberg : Springer-Verlag , Lecture Notes in Computer Science Vol 4173 (2006) p. 492 - 501 - Wąs Jarosław, Kułakowski Krzysztof: *Social Groups in Crowd* Encyclopedia of Social Network Analysis and Mining. Springer, 2014 - Wąs Jarosław: *Egress Modelling through Cellular Automata based Multi-Agent Systems*. Transactions on Computational Collective Intelligence, Springer - 2012 vol. 7 iss. 2 pp. 222 - 235.

- Wąs Jarosław: *Cellular automata model of pedestrian dynamics for normal and evacuation conditions*, Proceedings of Intelligent Systems Design and Applications Conference Wroclaw, IEEE CS Washington Brussels Tokyo (2005) 154 - 159.
- Gudowski B., Wąs Jarosław: *Some criteria of making decisions in pedestrian evacuation algorithms*. 6th International Conference on Computer information systems and industrial management applications, IEEE Computer Intelligence Society, Los Alamitos, Washington, Tokyo 2006, Challenging Problems of Science. Computer Science p. 93-96
- Mróz Hubert, Wąs Jarosław, *Discrete vs continuous approach in crowd dynamics modelling using GPU computing* , Cybernetics and Systems, Volume 45, Issue 1, Taylor & Francis 2014, pages 25-38

Validation References:

- Wąs Jarosław, Myśliwiec Wojciech, Lubaś Robert: *Towards realistic modeling of crowd compressibility* Pedestrian and Evacuation Dynamics : PED 2010 : the fifth international conference : Gaithersburg Maryland, 8-10 March 2010, eds. Richard D. Peacock, Erica D. Kuligowski, Jason D. Averill. - New York, Springer, pp. 527-534
- Wąs Jarosław: *Experiments on evacuation dynamics for different classes of situations*, International Conference on Evacuation and Pedestrian Dynamics 2008, eds. Wolfram W. F. Klingsch, Christian Rogsch, Andreas Schadschneider, Michael Schreckenberg, Wuppertal Springer-Verlag, pp. 225 – 232
- Wąs Jarosław, Lubaś Robert, Myśliwiec Wojciech: *The role of Proxemics in Pedestrian Evacuation*. *Comparison of simulation and experiments* Emergency Evacuation of People from Bulidings, Scientific Committee: E.Galea, V.Kholshevnikow, S.Schmidt, A.Stec, D.Samoshin, E.Kuligowski, J.Wolanin , www.BeSeCu.de, 2011

Availability: n/a - please contact authors

Price: n/a

Necessary Hardware: PC/Workstation running Windows XP, Windows 7 or Windows 8

Computer Language: C++

Size: 19.4 Mb

Contact Information: Dr Jarosław Wąs, AGH University of Science and Technology, Mickiewicza avenue, 30-059 Krakow, Poland
Mail: jarek@agh.edu.pl phone +48 126175219

Detailed Description:

Generalized Social Distances Model

The model is developed in order to calculate parameters of egress using microscopic, Agent based approach. The model uses Cellular Automata (CA), based on a detailed representation of space. Instead of the classical representation of a pedestrian in CA crowd models, as a state of 40cm x 40cm square cell, the authors use an idea of local configurations of neighboring cells sized 25cm x 25cm as a pedestrian representation Fig 1 (Social Distances representation was proposed by J.Wąs, B Gudowski and P.J. Matuszyk).

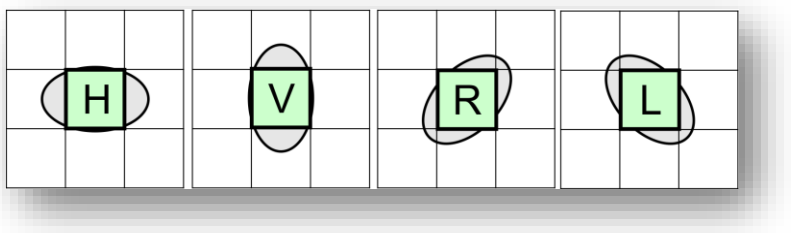

Fig. 1. Physical representation of pedestrians is based on Social Distances Model by J.Wąs, B Gudowski and P.J. Matuszyk 2006

The model was adapted for mass evacuation scenarios in 2012 by using a concept of static and dynamic floor field, as well as a cost function of pedestrian movement, developed according to specific representation of pedestrians.

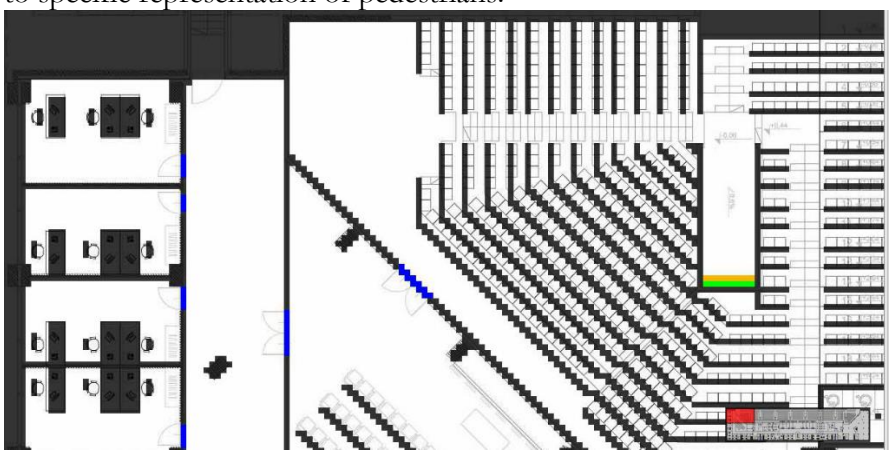

Fig. 2. Configured and discretized simulation environment – simulation grid is superimposed on AutoCAD plans of a facility (Krakow football stadium)

Simulation grid is superimposed on AutoCad plans of simulated facility in pre-processing stage of simulation (Fig 2). Next the simulation is executed (Fig 3) and finally, some statistics are generated for instance Trajectories (Fig 4) and Frequency matrices (Fig 5) etc.

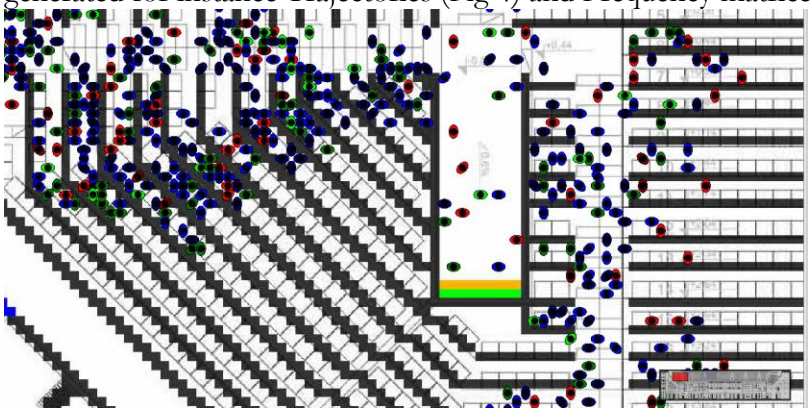

Fig. 3. Egress simulation - pedestrians are represented as ellipses.

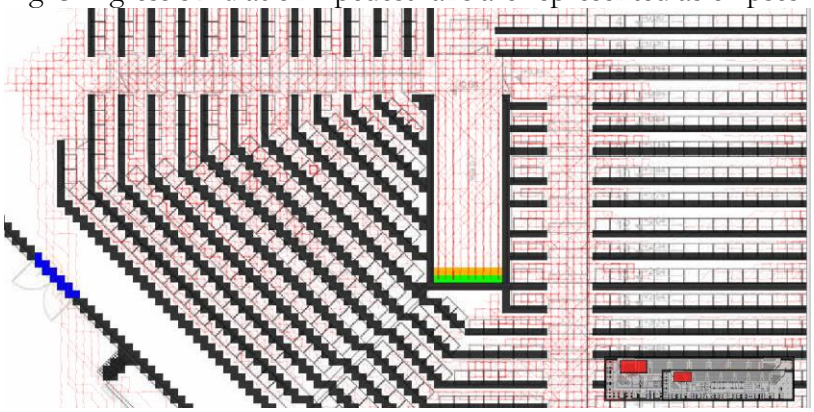

Fig. 4. Statistics of simulation - trajectories of pedestrians

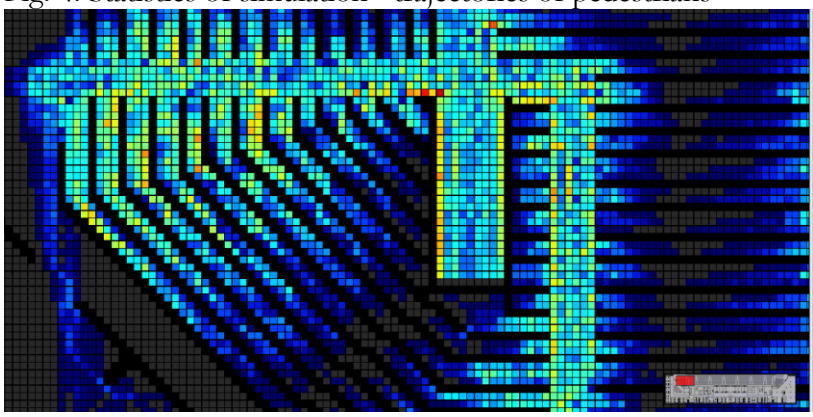

Fig. 5. Statistics of simulation - Frequency matrix.

The proposed model was implemented for several case studies ranging from test cases (in order to compare with empirical data and other simulations) to complex simulations of large facilities evacuation like:

- Municipal Stadium in Cracow, Poland,
- GKS Tychy Stadium Poland
- Integrated scenario of Allianz Arena Munich, Germany evacuation (as a part of 7th Framework Programme of European Union – project "Socionical").