

Models for Crowd Movement and Egress Simulation

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Summary. This paper lists models currently available for the simulation of crowd movement and egress simulation. The number of models that have been developed in the last decades are numerous and it is therefore neither possible nor useful to describe all the models in detail in a paper. This is even more the case since new models will be developed and existing models will be changed continuously. Therefore, the more appropriate approach for detailed model description is an open and editable website (wiki) which has already been put up:

tt www.gratis-wiki.com/ped-bib.

The outline of this paper is as follows: The first section contains some general remarks on models

1 Some General Remarks

Before going into the details of model classification, two clarifications shall be made. The first addresses the connection between theory, modeling, and simulation. This is depicted in fig. 1.

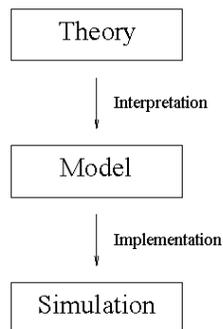


Fig. 1. Connection between theory, model, and implementation (simulation).

The second aspect is connected to the classification of data in general. This comprises empirical data as well as simulation results and is illustrated in fig. 2.

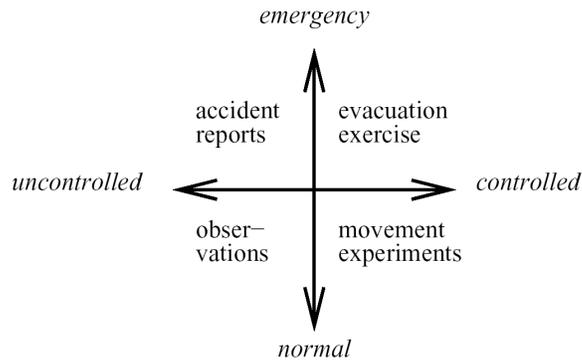


Fig. 2. Classification of data.

One might argue that this distinction between controlled and uncontrolled on the one hand and normal and emergency is present in the application range of a model, too. Of course, the general aim is to develop a model (and implement it correctly, which is an ambitious task in itself) that has a general range of application. We will get back to that topic in the next section.

2 Model Classification

Models can be classified on the basis of various schemas. Further details concerning model classification can be found in the review article [4].

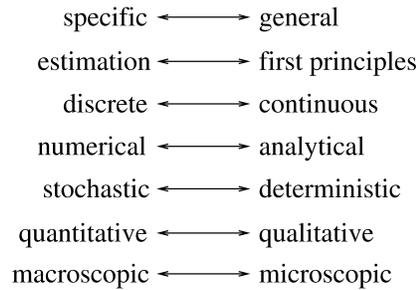


Fig. 3. Modeling criteria.

As already mentioned in the previous section, the general aim is to develop a general model in the sense that is able to cover all different scenarios (i.e., emergency as well as normal situations, reproduce uncontrolled/observed as well as experimental data). The further modeling criteria shown in fig. 3

are rather self-explaining. One criterion that might be added is high fidelity (many parameters) versus low fidelity (few parameters). The last distinction is more controversial than the ones shown in the figure, though.

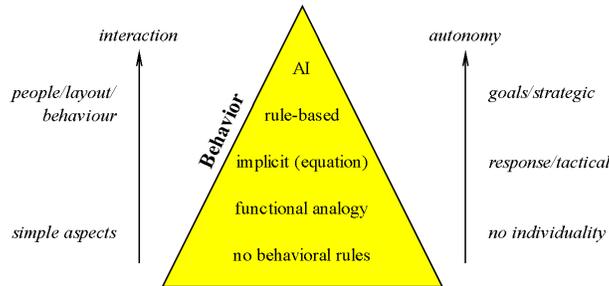


Fig. 4. Different levels of detail when representing decision making.

Another way of classifying models is concerning the population (i.e. the individuals - if there are any - in the model). This is shown in fig. 4.

3 List of Models

The following table contains a list of models for crowd movement and egress simulation that are commercially available.

| Name | Person | Comm. | Organisation | Links |
|----------------|-------------|-------|-------------------|--|
| Aseri | Schneider | yes | I.T.S | www.ist-net.de/ |
| Exodus | Galea | yes | FSEG | www.fseg.gre.ac.uk |
| PedGo (AENEAS) | Meyer-König | yes | TraffGo (with GL) | www.traffgo-ht.com |
| Simulex | Thompson | yes | IES4D | www.ies4d.co.uk |
| Simwalk | Stucki | yes | Savannah | www.simwalk.ch |

Table 1. List of Models investigated in [2, 5]

This list is completely biased and only for the sake of illustration. For a less biased and more complete list, please visit www.gratis-wiki.com/ped-bib. We have tried to include all the models that have come to our knowledge. It is clear from the beginning, though, that this list cannot be complete. Therefore, an interactive internet-site (wiki) has been put up. It can be reached at www.gratis-wiki.com/ped-bib.

Figure 5 shows a combination of the basic ideas. The models are there ordered by the representation of space (geometry). On the second level, the ordering is according to the persons’s perspective.

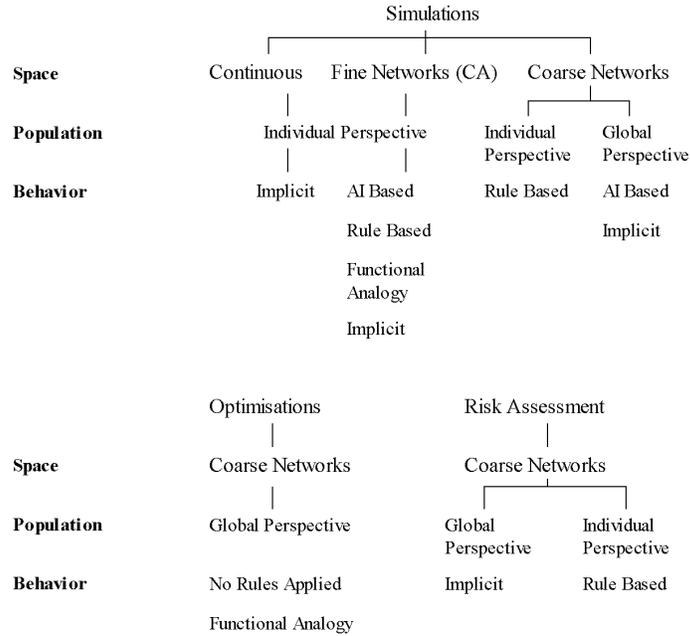


Fig. 5. Model overview.

4 Existing Model Reviews

In order to avoid reinventing the wheel, this paper rather aims at being a meta-review in the sense of listing review articles on models (and some empirical data and theory). Therefore, we list a few reviews.

- Firemodelsurvey www.firemodelsurvey.com – has also a section on evacuation models
- Kuligowski Review – The review of 28 models is available at the NIST website. The book by Tubbs contains an appendix with an updated version. [4, 8]
- Santos Review [6]
- Guidelines for Software Assessment [1]

This list is again non intended to be complete but rather a starting point.

5 The Wiki Approach

As has already been mentioned, the best choice to overcome all the problems of incompleteness and new models being developed is an interactive website where all model developers and those interested can contribute their knowledge.

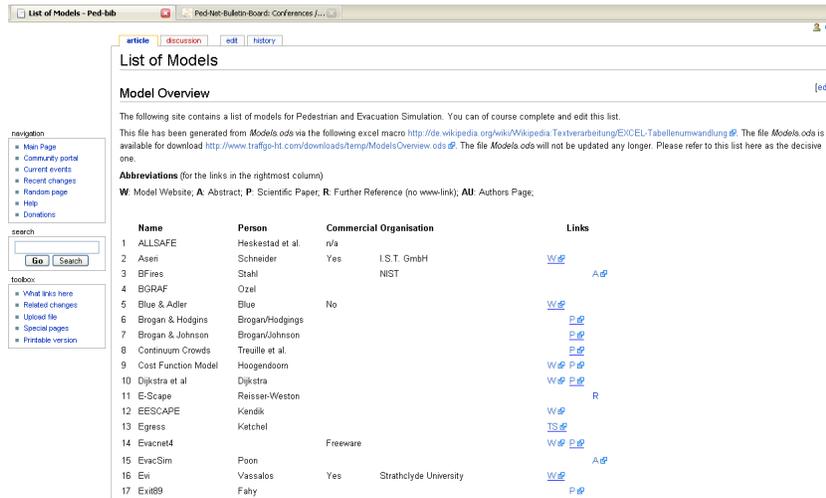


Fig. 6. A screenshot of the model wiki. The address is www.gratis-wiki.com/ped-bib.

6 Internet Resources

With respect to the rapidly growing number of models for crowd dynamics and the continuous updating and extension of existing models and simulation programmes, a complete and final list of models or description of a single model is hardly possible. This is an advantage and disadvantage at the same time. Especially when evacuation simulations are used to address safety issues, a well-defined version of the simulation or program is desirable and it is essential to be able to reproduce the results. Therefore, changes in the model must be documented in detail and explained with respect to their consequences for measurable quantities like flow rates, overall evacuation times, etc.

For covering the currently available models, the contribution of the model developers is pivotal. Otherwise, the list of models will always be limited by the knowledge and time of the author. Therefore, we have set up (within the framework of ped-net.org) an wiki site, where everyone can contribute his knowledge.

- The site www.ped-net.org is an internet bulletin board and discussion forum. Its strength is probably the discussion group with nearly 200 members (April 2008).
- The site www.evacmod.net is a similar project with a strong focus on a literature database where everyone can upload articles. Furthermore, there is a monthly newsletter containing information about new literature and recent events.

- Finally, www.safetylit.org is an internet site sponsored by the WHO that extracts literature information from numerous journals. It has an extensive search function which provides an excellent starting point for a literature search.

A recently published article provides a comprehensive overview over the theoretical and empirical foundations of pedestrian traffic [7].

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