

## Evacuation Simulation Models:

### Challenges in Modeling High Rise Building Evacuation With Cellular Automata Approaches

Nuria Pelechano, Ali Malkawi

*T.C. Chan Center for Building Simulation and Energy Studies*

*School of Design, University of Pennsylvania*

*Philadelphia, PA 19104-6311. (USA)*

*Telephone: +1 215 573 8718, Fax: +1 215 573 2192*

*E-mail: [npelecha@seas.upenn.edu](mailto:npelecha@seas.upenn.edu), [malkawi@design.upenn.edu](mailto:malkawi@design.upenn.edu)*

#### **Abstract**

Building evacuation simulation provides designers with an efficient way of testing the safety of a building before construction. A significant number of models have been developed in a variety of disciplines (computer graphics, robotics, evacuation dynamics, etc.). This paper presents a review of crowd simulation models and selected commercial software tools for high rise building evacuation simulation. The commercial tools selected (STEPS and EXODUS) are grid based simulations, which allow for efficient implementation but introduce artifacts in the final results. This paper focuses on describing the main challenges and limitation of these tools, in addition to explaining the importance of incorporating human psychological and physiological factors into the models. The paper concludes with an overview of fundamentals that should be applied to simulate human movement closer to real movements of people, where interaction between bodies emerges and flow rates, densities, and speeds become the result of those interactions instead of some predefined value.

*Keywords: Evacuation simulation tools, crowd simulation, high rise building design.*