Título Sequential evacuation strategy for multiple rooms toward the same means of egress

Tipo de Producto Publicación científica

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Código del Proyecto y Título del Proyecto

A15T14 - Reconocimiento y Análisis de Acciones en Videos

Responsable del Proyecto

Negri, Pablo

Línea

Procesamiento de señales

Área Temática

Informática

Fecha

2014

INTEC
Instituto de Tecnología

UADE FUNDACIÓN UADE

Papers in Physics, vol. 6, art. 060013 (2014)

www.papersinphysics.org

Received: 9 October 2014, Accepted: 13 November 2014
Edited by: G. C. Barker

DOI: http://dx.doi.org/10.4279/PIP.060013

ISSN 1852-4249

Sequential evacuation strategy for multiple rooms toward the same means of egress

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This paper examines different evacuation strategies for systems where several rooms evacuate through the same means of egress, using microscopic pedestrian simulation. As a case study, a medium-rise office building is considered. It was found that the standard strategy, whereby the simultaneous evacuation of all levels is performed, can be improved by a sequential evacuation, beginning with the lowest floor and continuing successively with each one of the upper floors after a certain delay. The importance of the present research is that it provides the basis for the design and implementation of new evacuation strategies and alarm systems that could significantly improve the evacuation of multiple rooms through a common means of escape.

I. Introduction

A quick and safe evacuation of a building when threats or hazards are present, whether natural or man-made, is of enormous interest in the field of safety design. Any improvement in this sense would increase evacuation safety, and a greater number of lives could be better protected when fast and efficient total egress is required.

Evacuation from real pedestrian facilities can have different degrees of complexity due to the particular layout, functionality, means of escape, occupation and evacuation plans. During the last two decades, modeling and simulation of pedestrian movements have developed into a new approach to the study of this kind of system. Basic research on evacuation dynamics has started with the simplest problem of evacuation from a room through a single door. This "building block" problem of pedestrian evacuation has extensively been studied in the bibliography, for example, experimetally [1, 2], or by using the social force model [3–5], and cellular automata models [6–8], among many others.

As a next step, we propose investigating the egress from multiple rooms toward a single means of egress, such as a hallway or corridor. Examples of this configuration are schools and universities where several classrooms open into a single hallway, cinema complexes, museums, office buildings, and the evacuation of different building floors via the same staircase. The key variable in this kind of system is the timing (simultaneity) at which the different occupants of individual rooms go toward the common means of egress. Clearly, this means of egress has a certain capacity that can be rapidly exceeded if all rooms are evacuated simultaneously and thus, the total evacuation time can be suboptimal. So, it is valid to ask in what order the different

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