Master's thesis proposal

Technische Universität München

E R A

Ingenieursfakultät Bau Geo Umwelt
Engineering Risk Analysis Group
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Probabilistic safety concept for evacuation analysis and building fire safety

Background

In case of a fire event, buildings need to be safely evacuated before heat and smoke prohibit evacuation. Performance-based design of egress routes takes basis in computer simulations to quantify the time needed to complete the evacuation (Required Safe Egress Time – RSET), and the time available before the conditions become untenable for building occupants (Available Safe Egress Time – ASET). Uncertainties associated with these calculations are covered by requiring that a certain margin remains, but no probabilistic safety concept is used to define how large this margin should be. The goal of this project is the development of such a safety concept, linking safety factors with explicit acceptance criteria for risk to human life.

Objectives

The student conducting the proposed MSc thesis will learn:

- How to perform simple safe egress calculations (ASET/RSET) using hand calculations methods and analytic correlations for evacuation analysis and fire development.
- How to model the uncertainties associated with these calculations, and to conduct reliability and risk analyses to derive the probability and expected number of fatalities in case of a fire.
- How to use these analyses to develop a safety concept for safe egress calculations, starting from the existing Eurocode safety concept for structural design against fire actions.

Methodology

The suggested work flow is as follows:

- In the first phase of the project, the student will set up a simple evacuation analysis, and combine it with a quantification of the uncertainties associated with the relevant input variables to derive quantitative estimates for the risk of fatalities due to building fire events.
- The student then needs to understand the basic principles of the Eurocode safety concept for structures in fire situations, and to discuss the major differences between structural design and the design of egress routes.
- In the final stage, the student will develop a probabilistic safety concept for safe egress calculations and derive safety factors as a function of the acceptable level of risk to life in fire events.

Supervised by:

TBA

The project will be co-supervised by Dr. Katharina Fischer from Matrisk GmbH (fischer@matrisk.com, www.matrisk.com)

Starting date: flexible