



POLITECNICO
DI TORINO

Honors thesis

Master of Science in Sustainable Architecture

Fire is one of the most severe hazards to which built infrastructure and human lives may be subjected. In the last few years, the development of modern technologies such as numerical simulations, virtual and augmented reality, represent a proper alternative to the actual fire drill. This work introduces a multiscale methodology for the simulation of fire emergency response through a virtual reality-based system by integrating a computational fluid dynamics (CDF) computer software into a virtual reality model. The proposed methodology offers an accurate visualization of the fire propagation and its progressive extension. This represents an important aspect of the work, since to date, fire emergency scenarios have been simulated by using internal libraries and features of virtual reality software (e.g., particle system in Unity software). To demonstrate the applicability of the proposed methodology, two case studies at different scales are proposed: a building school in the hinterland of Milan and the city of Bolinas in California. Results show that the methodology can be used for reproducing

fire emergency scenarios realistically and can help decision-makers to determine the fire rescue and fire protection planning. Moreover, the proposed virtual reality-based system can be used by firefighters to perform repetitive emergency evacuation and rescue training and improve their abilities in a safe environment.

Multiscale modelling and simulation of fire emergency evacuation using advanced technologies

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