Summary

Methodology for Shaping the Ergonomic Quality of Evacuating People with Disabilities from Buildings Using Evacuation Chairs

This dissertation examines the ergonomics of evacuation systems, specifically how evacuation chairs are used to evacuate people with disabilities from multi-story buildings. The aim of the study was to develop a comprehensive methodology for assessing and improving the ergonomics of the evacuation process, taking into account the interactions between users, equipment, and the architectural environment. The research was conducted in multiple stages, combining qualitative and quantitative methods. It included a systematic review of scientific literature, interviews with organizational decision-makers responsible for evacuation safety, and an analysis of the spatial conditions of evacuation routes. The research also assessed the ergonomic aspects of evacuation chairs using Motion Capture technology to measure the biomechanical loads on operators, as well as a survey of 102 users that assessed the functionality and ergonomics of two types of evacuation chairs. The research results indicated a clear ergonomic advantage of chairs with four fixed wheels over models with folding wheels, expressed in reduced strain on the operator's musculoskeletal system (torso tilt 4-6° vs. 12°). It was concluded that evacuation effectiveness is determined not only by the equipment's design but also by its compatibility with the architectural environment and the competence of users. The main outcome of the dissertation is a comprehensive methodology for shaping the ergonomic quality of evacuation systems, containing detailed procedures for three groups of stakeholders: equipment designers/manufacturers, organizational decision-makers, and operators. The methodology integrates design, organizational, and operational aspects into a coherent system of optimization activities. The dissertation introduces a new approach to evacuation ergonomics, treating it as a dynamic factor shaped by the synergy of user competence, technical properties of equipment, and process organization. The developed methodology is a practical tool supporting the improvement of evacuation systems, increasing the safety of people with disabilities in dangerous situations.