Ph.D. Thesis: ***Aspects of Kinetic Architecture - Towards Responsive Design with Information Technology***

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Abstract

The dissertation addresses the topic of design solutions in the field of kinetic architecture and the reconfiguration of architectural and urban spaces against a background of issues related to new technological tools of the latest industrial revolutions and the development of responsive architecture. Kinetic architecture is understood here as the concept through which buildings are designed to allow parts of the structure to move, without reducing the overall structural integrity. This work also includes elements not integrated with the building structure, allowing for geometric modification of the analyzed space in a period of time not exceeding one day, including portable modules.

The aim of this work is to analyze the implementation of objects described as kinetic architecture in the first two decades of the 21st century by defining their functional, technical and aesthetic features, as well as the conditions of their design, implementation and use. The secondary aim of this work is to take into account the design of reconfigurable and multifunctional public spaces and the safety of the space, which is equipped with mechanized moving elements, for use.

The first part of this work outlines the historical background of architecture with changeable geometry, taking into account research trends in this area in selected university centers. In the latter part, the technical conditions for the automation of kinetic systems are briefly discussed in relation to the design of mechatronic systems.

The next part of this dissertation presents an investigation of the author's database, comprising 145 objects described in the analyzed literature as kinetic architecture, with particular emphasis on the functions performed by kinetic elements introduced into the analyzed objects, divided according to the building type.

The final parts of this work focus on the currently used and potential solutions in the field of changeable architecture in public spaces. Case studies of the selected implementations of kinetic and reconfigurable architecture in public spaces are presented here, as well as the results of design research undertaken with the participation of students of the ROBOstudio experimental project in 2019–2022, aimed at determining potential directions of the development of architecture enriched with mechatronic technologies, i.e., architectronics.

Key words: kinetic architecture, responsive architecture, architectronic, changeable architecture, architecture of change, reconfigurable architecture.

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