

PARAMETRIC GREEN FOOTBRIDGES IN URBAN SPACE. A NEW APPROACH TO DESIGN ENVIRONMENT-FRIENDLY STRUCTURES

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SUMMARY

In the 21st century, digital design tools, which are interfaced with the CNC technology, have opened the new opportunities that not only are shaping structural objects, but also interfering with the urban tissue. The first part of the paper defines the main features of the “green” approach to the built environment. Selected examples illustrate diverse approaches to designing footbridges, and what combines them is the use of digital tools, especially the topological and analytical ones, in shaping and constructing parametric forms. The second part presents how structural engineers and architects can develop a new framework for the urban design by correlating digital morphogenesis and ecology. This integrated “morpho-ecological” approach has resulted in a new kind of eco-friendly bridges, based on the modulation of micro-environmental conditions within an emergent macro-environmental system. The conducted research has presented alternative ideas of efficiency and sustainability.

Keywords: *Structural engineering, parametric design, environment-friendly structures, green footbridges.*

1. INTRODUCTION

Footbridge structures contain a multiplicity of stable states that link changing spatial requirements to a corresponding formal and structural articulation. These complex environment-friendly forms demand new tools and a new approach to design. Structural engineers and architects achieve this through a design strategy that combines digital and material processes. There is an increasing number of research studies on the methods of providing crucial design parameters for creating performance structures, which allow buildings to react to changes in environmental conditions as well as minimise harmful effects on human health and the environment [1]. The new approach has shifted the questions of environmental friendliness away from the traditional formal and physical properties of building structures to reposition the discourse within a more expansive definition of how they behave. Today, digital technologies offer a wide range of research and calculation possibilities. Completed in 2001, the swing bridge for pedestrians Gateshead Millennium Bridge in Newcastle is the first bridge structure formed completely digitally – from the design concept, through execution, to its assembly and locating it at its destination site. The documentation of the project had been recorded in 3D with the help of digital design tools, which had allowed it to be manufactured in the CNC technology [2]. At present, the parametric design, three-dimensional modelling techniques and rapid-prototyping technologies, four-dimensional animation and simulation protocols, as well as synchronised multimove robotic systems, lie at the core of the theorisation and manifestation of post-digital structural and architectural production – in academia as well as in practice. Although there is a strong emphasis on geometry, materiality, feasibility and sustainability, what emerges is an explicit agenda promoting material ornamentation, spatial spectacle and formal theatricality. Assuming that architecture is cultural production, its talk discusses the intrinsic parametricism or neo-baroque of the present-day architectural debate with a critical eye directed at the engagement of technology and emotion on various scales (from micro- to macro-scale).