

VIRTUAL PARAMETRIC 3D MODEL OF A PEDESTRIAN BRIDGE ON A 3D VORONOI DIAGRAM

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ABSTRACT

The shape of all constructions has its origin in a geometric shape, such as a cuboid, a pyramid or a cylinder. Every builder (architect or civil engineer) has determined the choice of geometric shape for the requirements of a building primarily by its purpose, but in addition to this utilitarian condition, he also wanted to achieve a certain aesthetic impression. This desire to achieve the desired aesthetic impression led to the use of increasingly complex shapes and their combinations, and this became even easier and simpler with the use of 3D modelling technologies on the computer. The aim of this work is to present a virtual 3D model of a pedestrian bridge inspired by a 3D Voronoi diagram based on a pseudo-random distribution of points in space, created in the form of a parametric model using the computer programme Rhinoceros 3D and its additional tool for visual programming and creation of parametric models Grasshopper. The model obtained in this way facilitates the creation of solution variants of the building, all with the aim of finding the optimal form that meets all the technical conditions for the stability of the structure, fulfils the function for which the building was designed, and finally gives the desired aesthetic impression and fits the building into the space. The Voronoi diagram was chosen as the basis for the creation of the structure due to its organic structure. It gives the building a high-quality aesthetic expression with a good possibility of meeting the technical conditions that the building must fulfil.

Keywords: bridge, Grasshopper, parametric modelling, Voronoi diagram

INTRODUCTION

The design process of a building or a structure is complex, and it requires a coordinated cooperation between many different participants such as architects and civil engineers. The design process goes through different phases from a basic idea concept all the way up to detailed designs. Even for the design of simple structures different computer software is needed (e.g. CAD software), and for the design of complex structures computer software is necessary and indispensable. The use of computer software for their design enables designers to be more creative, especially for the design of unique structures which try to stand out with their appearance and try to distinguish themselves from their surroundings. To achieve this, designers usually used standardized products, for example such as bricks, tiles, or concrete poured in standardized formwork, but had to use them in unconventional ways. With the development of modern building technologies and with the development of modern CAD software, the designers got new possibilities and new potential to design unique structures which could all not be possible only a decade ago.