The construction engineering of the digital design of free forms.

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Summary

This paper addresses the analytical study of the set of technical solutions that will be applied in the construction of complex surfaces and its typological evolution towards a new structural definition of the digital design of free forms, that constitutes the foundation of the documental basis for the investigation on the importance of the new structural and constructive systems in the production of construction engineering in architecture of the first quarter of the 21st century.

Keywords: Free-Forms; Complex Surfaces; Digital Design; Advanced Technologies; Lightweight Structures; Building.

1. Introduction

A great part of Engineering History during the 20th and 21st centuries has been without a doubt linked with the development of the great cladded envelopes. The introduction of new technologies and constructive materials at the beginning of the 21st century is also contemporary with the demands of applying new programs and the need of developing high-rise constructive types, long spans and envelope cladding of complex geometries with a high formal indetermination level of typological characteristics non-experienced until that moment in the fields of engineering and architecture. Engineers and architects have been obliged to confront the resolution of those challenges with new scientific-technical knowledge and the generation of digital design of shapes that is developed concurrently to the evolution of new constructive techniques, shaking up the production techniques of the construction engineering.

The application of aeronautical and naval industry software to the field of architecture and construction engineering introducing the latest developments in digital design, will be widely applied and experimented in the construction of surfaces, where the benefits in the definition of complex non-euclidean geometries, with demands of high resistance, long spans and continuous spatial development, will make possible the solutions employed by architects such as Hadid, Schumacher, Franken, Goulthorpe, Jakob & McFarlane, Rahim, Asymptote, CAP, Kolatan and Mac Donald among others, and engineers such as Schlaich, Boelinger, Sasaki, Sobek, Arup, Balmond, Kara, AKT or Hunt.

2. Morphogenetic design strategies

The Interrelation between the digital techniques of design, production and manufacture permitted innovative dispositions in organizing materials in order to their particular characteristics of physical constitution. The parametric definition of the digital designs permits to establish solutions whose basic geometry is generated departing from criterions of growth of the designs of atomic configuration of some materials and whose geometric complexity is subject to be interpreted in different scales. [1]

The new systems of digital design and manufacturation offer the possibility to create forms whose characteristics of material continuity are structured departing from the fabrication processes, particularly in materials as the compounded textiles. Architectural Association Design Research Lab

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