

POLITECNICO DI TORINO
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Master of Science in Architecture (Construction)
Honors theses

R_pavilion: form finding & digital fabrication

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The thesis project concerned the design of an R-pavilion in which has been explored a form finding process through the application of morphogenesis and physical topology of the skeletal structures of radiolarians, protozoa that inhabit the oceans of our planet, implemented in the digital space through generative algorithms to a generic geometry and consequently its manufacture through numerical control machines .

The pavilion resulted the most suitable architectural typology for this kind of design process because it was supposed not to have a peculiar function and, consequently, a specific form. It has been considered a space of experimentation and research, in which the functional concepts expressed a particular idea or circumstance and the target was the construction in itself that became an instrument explaining a purpose, a function, an image.

The main characteristics were its ephemeral nature and the ability to describe the compositional research as a unity, joining together the environmental and architectural scales in the definition of a generative process space.



R_pavilion: front and rear view



R_pavilion: left and right side views

The preliminary and theoretical approach of the project has been the definition of an association of rules and assumptions, synthesized through the computation of data, and, their translation into a form in the digital space through the creation and composition of generative algorithms. The tools used in the design have been aware from the work of D'Arcy Thompson, "On Growth and Form". According to D'Arcy Thompson, the morphology considers the shape as a structure because it presents characteristics of disposition, configuration, organization, structure, sort. Therefore, the form is perceived as result of a dynamic process and no longer in a static sense.

The morphological approach of the British biologist has been applied and extended by 'architect Frei Otto, the architecture through the "form finding": a method that developed a mathematical-geometrical-mechanical theory in order to reduce different expressions in a unique generative model. The forms have been considered in relation to the growth process, in which the forces, applied on the material, became the cause of both their origin and their changes. R_pavilion represented the synthesis of associative elaboration in the design process, in which the generative algorithms acted as tool to build bridges connecting heterogeneous elements and composing them in an architectural form.

R_pavilion is the result of morphological and topological rules of radiolarian protozoa, transposed into a digital model. Therefore, by the tassellation method the 3d model was discretized, in small modules that reproduce radiolarian's skeletal structure.



R_pavilion: structure's modules of the pavilion we can see the analogy with the skeletal structure of radiolarian protozoa

In synergy with the Computer Aided Manufacturing, design decisions have been tested in different scales, through the implementation of prototypes that showed the real possibility of fabrication and assembly, made in the digital space and then transposed into physical reality.

This analytical method is becoming an emerging phenomena that is totally involved in the design of contemporary architecture. The drawing is only a part of the potential of algorithmic computation, which could allow you to manage and compose a large number of variables, arranged in multiple hierarchies and in a high level of complexity, representing the space of contemporary society. The architect, thanks to this generative design process, could imagine and synthesize a large number of elements and heterogeneous languages which interact all together in the architectural composition. The result is the direct translation of these components in the architectural space.

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