Natalie's Ramonda pavilion

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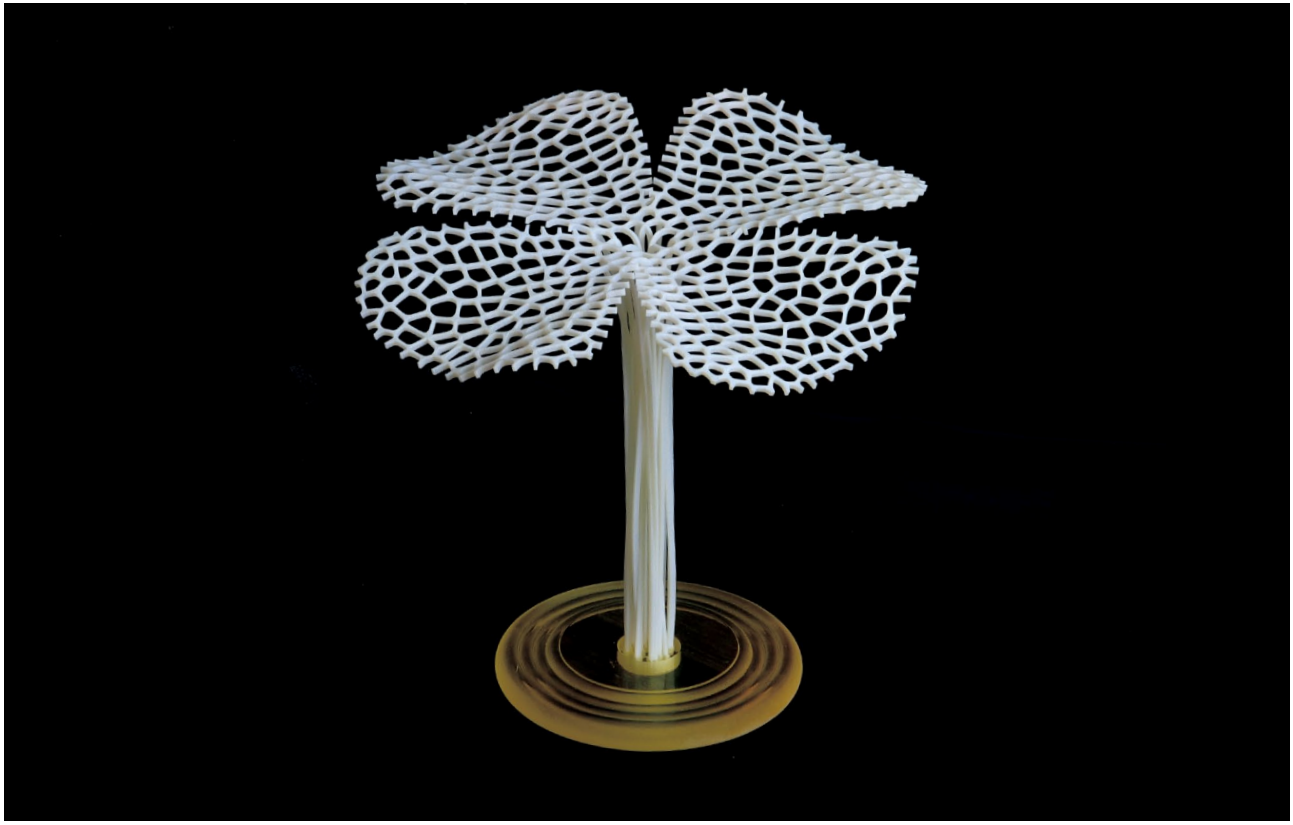
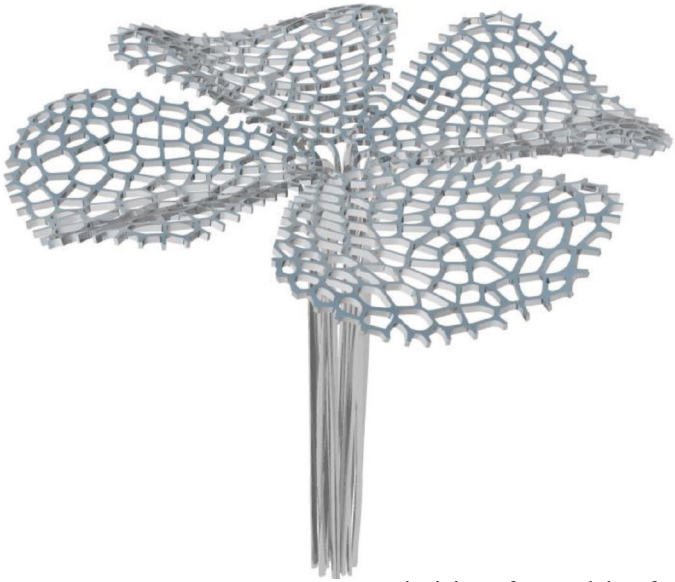


Biljana Jović, Komnenov Mirjana “Natalie's Ramonda pavilion” 2017, Material: VeroWhite, Size: 188W x 188D x 172H (mm)

Natural shapes are increasingly used as inspiration for design. Flower forms stand out because of their beauty, so we find them inspiring. The species of choice for us is Ramonda nathaliae P. et P., characterized by unusual traits of poikilohidry and limited range. Its flower shape is simple and consistent, and therefore a suitable basis for the extraction of the form to be used for generative modeling. We transformed the surface of flower petals into the Voronoi pattern, generated them using software tools, and developed them in the model of the Natalie's Ramonda pavilion.

Keywords: *Ramonda nathaliae* P. et P., Voronoi, pavilion



1 *Ramonda nathaliae* P. et P. as inspiration

More often natural forms are used in the design, whether through inspiration or literally because of its quality, whether they are singled out in the structure, function or beauty of form. The possibility of implementing biomimetic principles in spatial design, provides an opportunity for the development of different generative model based on parameters that originate from nature, and whose configuration is adapted to the requirements of spatial structures [1]. The development of biomimetics and digital technology has found its synthesis in the generative design, which is driven to a realistic level by digital fabrication. Implementation of natural forms through the design and spatial structure has so far been limited imitation of organic forms, however generative design offers unlimited range of obtaining a form and therefore transcends that problem [2,3]. Starting from the viewpoint that plants are the most perfect living organisms, our interest is aimed in their direction. Among the plants and their organs, there are many variations in shape, but generally flower stands out as organ that varies the least in its form and function, yet because of its beauty

Figure 1: Ramonda nathaliae P. et P. flower

attracts the most attention [4]. Precisely for these reasons we determinated this part of the plant as the basis of our ideas, and we find inspiration in the flower species *Ramonda nathaliae* P. et P.. *Ramonda nathaliae* Pančić et Petrović is species of unusual characteristics having in mind that it is characterized by traits poikilohidry and limited range, since is endemic species in Serbia and Macedonia. Among people it is also known as the Phoenix flower, because of its features that allows her to survive in state hibernate in unfavorable conditions and suspend its flowering until favorable conditions occurs. It was named after Serbian Queen Natalija Obrenovic. This is a perennial plant whose flower stalks usually carries 1-3 flower. Diameter of each flower is 3-3.5 cm and is characterized by actinomorphic (radial) symmetry. The flower is made of 4-5 calyx and 4 articulated flower petals (exceptionally 5) [5].

Flower build is simple and consistent, and therefore suitable basis for extraction in the form that will be used to carry out generative model form. In the process we streamed surface of the flower petal into the Voronoi pattern, then generate it by using software tools, and developed in the model of a pavilion.

2 Method

To start, the surface of petals we imagined as a Voronoi grid. In the process we used a photograph of the flower [6]. Based on the photo and nervs of the flower petals of *Ramonda nathaliae* P.etP., characteristic starting points are positioned as a basis for the future pattern, respectively the centers of cells of Voronoi diagram. Comprehensive Voronoi structure is derived by applying software Rhinoceros and it plug-in Grasshopper by linking appropriate components with the

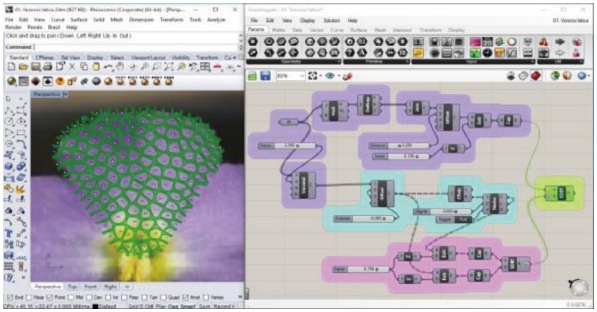


Figure 2: Rhinoceros - Grasshopper configuration

parameters. In this way the arrangement of nerves is translated into a form whose structure corresponds to the surface of the flower petal.

This structure is flat, and the further procedure of generating model comes down to bending model surface to obtain a wavy shape of the petal. The basic design tools within the software package allows us to manipulate this object as part of the design process through which is made a modification that affects on the spread of the model, the morphological characteristics of form and proportion, changes that manifest themselves visually and directly on the model, until the desired result is achived.

In a further process, the petal has served us as a design pattern. The application of natural form in the framework of generative design identical to the role of designers who directs his creative energy in the experiment with a design that offers plenty of opportunities as an outcome of this process [7].

Translation parameters, which has set itself the nature and use them in the experiment search form, it is possible to perform the objects that in essence contains the basic pattern flower petal, to obtain a concrete model. In a further stage of

Figure 3: Pavilion implemented in the space

searching a suitable form so that we can take advantage of the resulting Voronoi pattern we have come to pavilion model. Voronoi structure is limited by the edge of the petal of a flower. Petal of the flower is basically presented as a single wing of pavilion and edges of Voronoi petal witch match the center of the flower is continuing smoothly into the pillars. In this way, the structural differences between the petals and pillar are invisible crossed. Modeling of the object is basically derived by generating surface of wing-petals and pillars obtained by sweep command based on the rail represented by manually defined curve. In order to obtain a final solution, or to set the thickness of the structure, surfaces are offset to a specific thickness. The final model of pavilion that corresponds to a structure of the flower, was obtained by petals that are repeated 4 times in a circular arrangement.
The resulting model is designed as a landscape-architectural installations in the space.

3 Software & System

The model is done in system with performances of 2.4 GHz i5 Intel Core x64-based processor and 6 GB of RAM. In a process we used Rhinoceros software with Grasshopper plug-in.

Acknowledgement

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