



PARAMETRIC DESIGN AS A PROCESS ORIENTED DESIGN SOLUTION

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Abstract: The styles in the field of architecture were changing day by day. Parametric design is one of the futuristic designs. It is a new approach to architectural design based on the concept of parameters which provides great opportunities for architects and engineers. But the Parametric architecture will be difficult to attain manually, it can be done by using digitally (using software). Although earlier the software were used as a drafting tool for architects. Now in modern day, its lightly shifting as a design tool for architects.

Index Terms - Parametric design, Futuristic design, Algorithmic thinking, CATIA, Geometry.

I. INTRODUCTION

Parametric design is a design based on algorithmic thinking, mathematical equations, complex geometries etc... Modern Architects namely Antoni Gaudi attains modern parametric designs by analog models to explore design space. The parametric design is a new source of form finding solution for aerodynamic designs, fluidity structures for futuristic architects. CAD software is one of the parametric software which is used to create Parametric form.

II. PARAMETRICISM

Parametricism is a new style of modern day architecture, which is a successor to post-modern architecture and modern architecture. The term Parametricism was coined in 2008 by Patrik Schumacher (Architectural partner of Zaha Hadid). The Parametricism was used in Urban design, architectural design, landscape design, interior design and furniture design.

2.1. ORIGIN

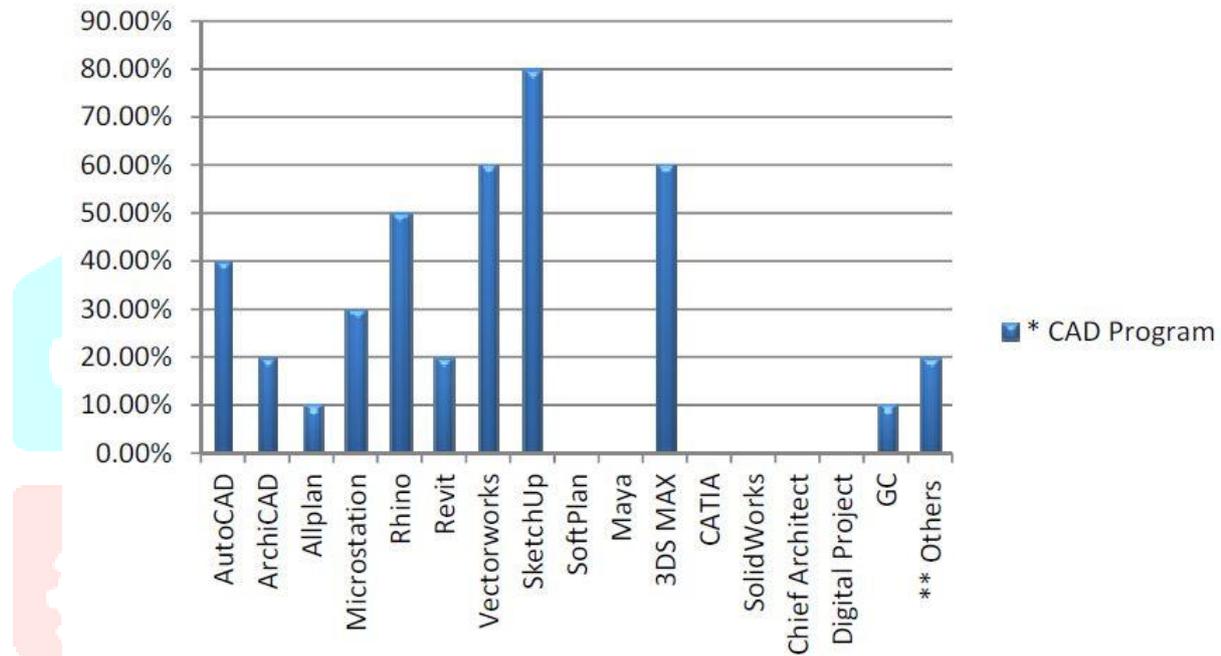


1.1 Parametric design inspired from nature (Source : <http://esa-bpa.blogspot.in>)

The parametric design is always inspired from nature. Natural forms is one of the best design in the world which have all the capability to with stand air, water, temperature etc, because natural forms are designed in such a fashion to resist all these external features. Nature does not have any geometric shapes such as cube, cuboids, etc.. Nature only have the parametric forms. In the below image we can see the facade of a building which is inspired from the water drops. This is how all the forms were generated in the conceptual level of parametric design. Later it was converted digitally into parametric forms with the help of advanced software such as CAD, Grasshopper, Rhino etc.. Thus Parametric forms are originated from nature.

2.1. HOW TO ACHIEVE PARAMETRIC DESIGN

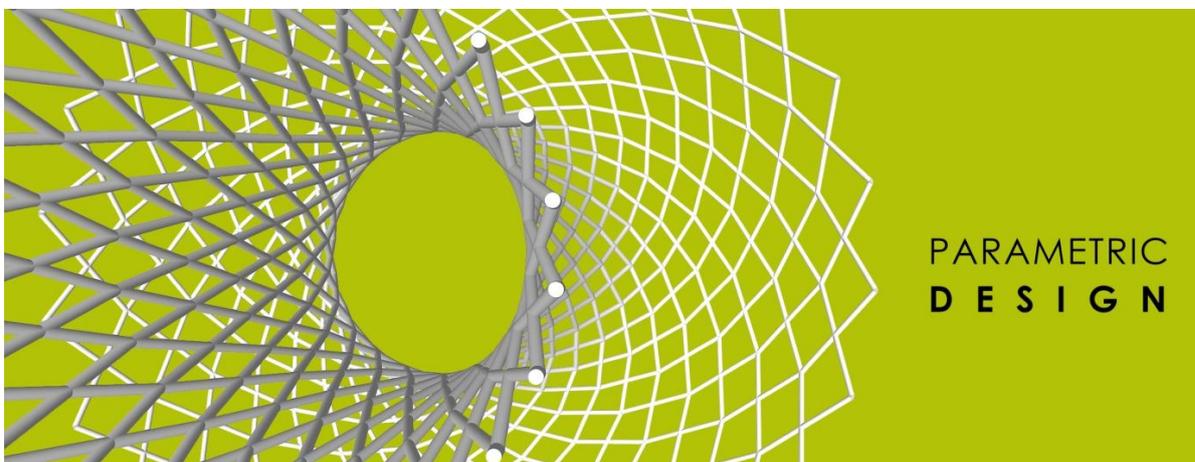
Earlier buildings were designed manually with the help of basic tools. As years goes on new styles were originated in the field of architecture. Parametric design is also one of the futuristic style. But Parametric design will be very difficult to attain by manual drawings. It can be attained with the help of computer software. Computer technologies have made good software and applications for designers and Architects. Greg Lynn was the one of the first Architect to use computers to generate architectural designs. CATIA (Computer Aided Three- Dimensional Interactive Application) is one of the parametric design software, which can evolve parametric designs. Guggenheim Museum by Frank Gehry was designed by Parametric design software. The software in modern day get updated day-by-day in order to satisfy the design needs. Some of the software which are used to develop the Parametric design are Autodesk 3DS Max, Autodesk Maya, Grasshopper 3D, Autodesk Revit, Autodesk Dynamo, Arch matrix, Sketch Up, etc.. These software will have more plug-in and features to achieve parametric forms. These software will make the job of the Architect easier.



1.2. Usage of software (Source : Yasser Zarei, SED)

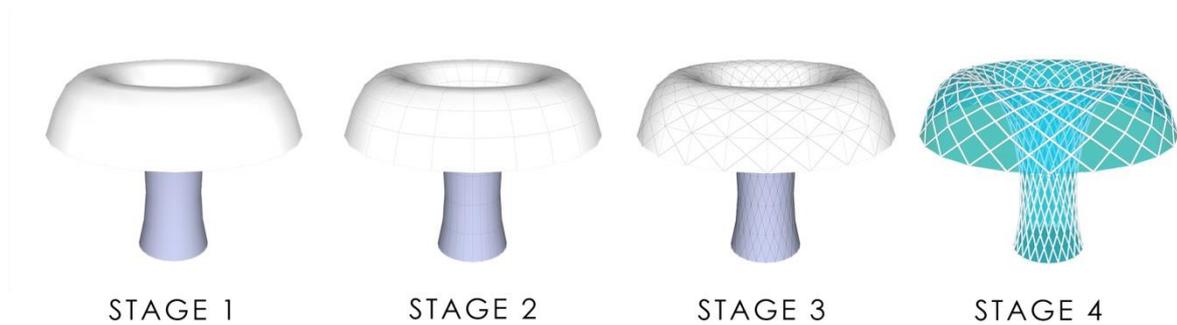
The graph mentions that sketchUp is one of the most commonly used software for the development of parametric design. Even though the features in the sketchUp are very less than Grasshopper 3D, and other futuristic software the sketchup was used commonly by budding architects.

2.3. DEVELOPMENT OF PARAMETRIC DESIGN



1.3. Parametric design (Source : Author)

Software were used as a tool for the development of design. Although it cannot used to find the idea of an architect. The example shown in the image was developed by using sketchup software. All the parametric structures have a hidden geometry in it. The parametric structure was developed with the help of hidden geometry. Parametric design will be developed by few stages.



1.4. Development of Parametric design (Source : Author)

STAGE 1: The form of the parametric design will be evolved by using various tools of the software.

STAGE 2: Every form including the parametric form will have a hidden geometry in it. The hidden geometry was found and overlaid with the form.

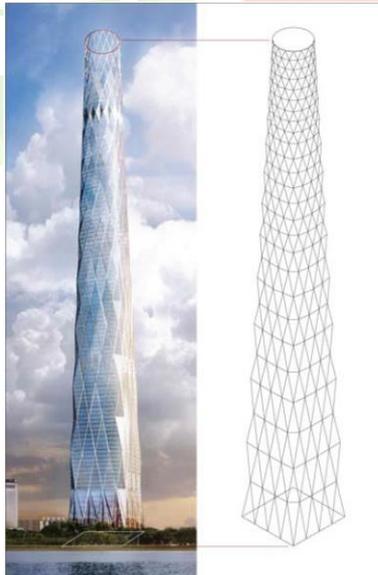
STAGE 3: As per our requirement we want to add more lines in the form. Adding more details will conclude with better output.

STAGE 4: This is the final stage of the parametric design. The lines in the earlier stage will be converted into form (Conversion of 2D into 3D). The plains in the previous stage was converted into the required material.

III. CASE STUDY – LOTTE SUPER TOWER

The Lotte Super Tower was with geometry of 555m tall, begins with a constant transformation from a square base to a circle top. This concept is conceptually structural as well as architectural transformation in order to shed wind vortices that occur in unchanging kind, taper for efficient mass distribution of mixed-use program which need varying lease spans. The geometrical challenge of transforming a square shape into a circular was resolved by creating triangular facets on the building.

The AUTOCAD platform was used as a design tool in the development of this structure, it also needs a platform for the mathematical development of the geometrical design while evolving the tower. The programmed operations cannot be used in AUTOCAD specific functions, hence AUTOLISP was used for handling those data.

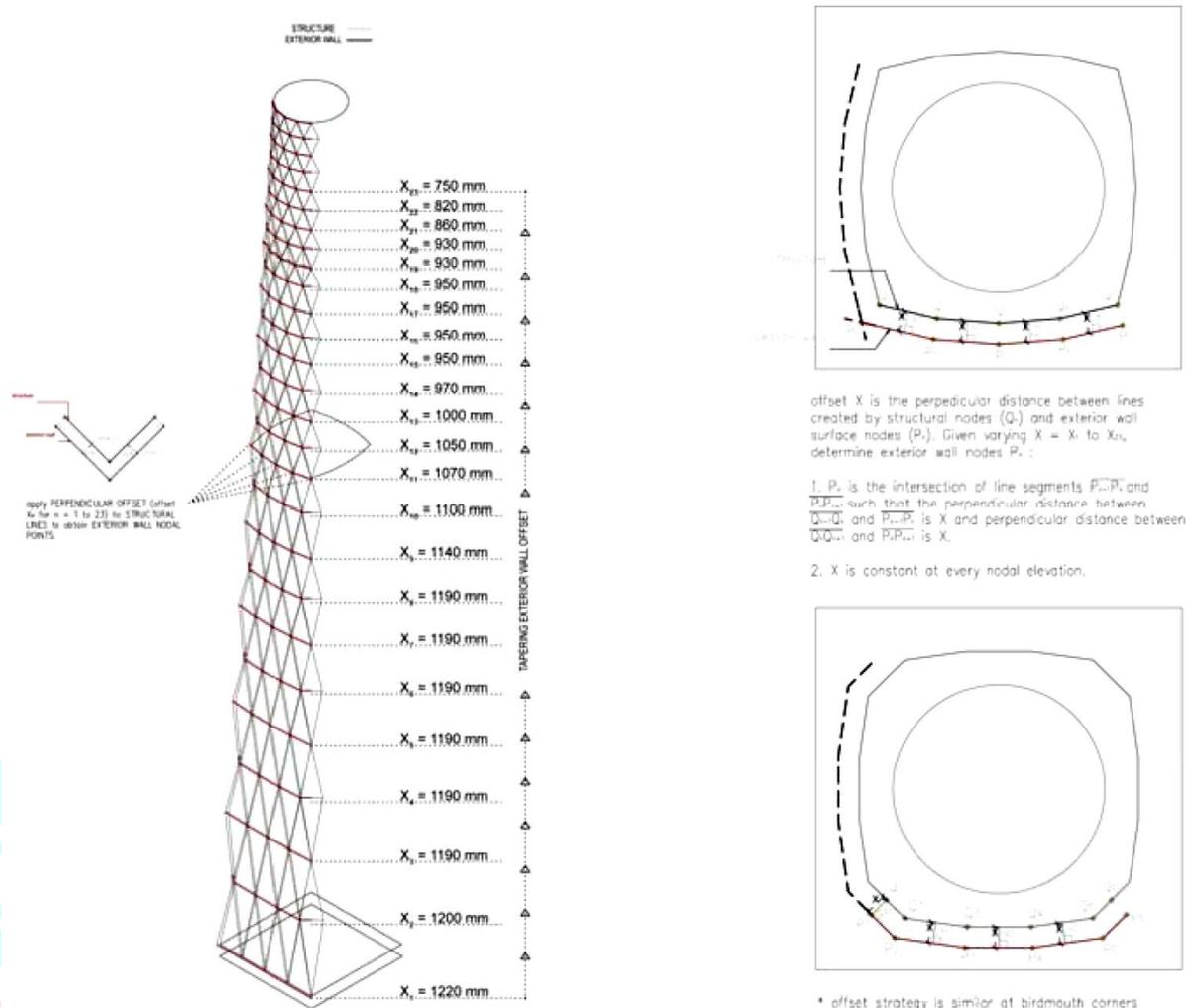


1.5. Lotte super tower (Source : Kat Park and Nicholas Holt)

The shape of exterior wall of the tower was determined by offsetting the structure's centroidal wireframe in a systematic geometrical manner. The base of the ground floor plan was square shaped and the top floor was in circular shape. The floor plans will be changing from square to circle form . The transformation can be seen in the below image. The edges will get curved as it goes on every top floor from ground level. At the end it ends with circular form. This will be applied only on the floor plans.

The case of facade will be different. As the facade travels from bottom to top, it changes drastically in its nodes. Triangular and quadrilateral shapes will be introduced while it is travelling towards up. The building facade was finally done by glass. Every glass will have its varying dimensions. Each glass was drafted based on the design, later it will be installed in the building.

The entire process will be done by the software and the estimation for the parametric design can also be done with the help of the software.



1.6. Development of exterior facade (Source : Kat Park and Nicholas Holt)

IV. CONCLUSION

In the 21st century the Architecture forms was improved a lot. The new architectural styles are travelling towards futuristic design. The parametric design can only satisfy the futuristic design and digital architecture. A large scale project can only be attained by parametric designs. The service in a parametric structure will be differing from other common buildings. Hence the service in the parametric structures was also specially designed. Since the parametric structures were differing from one building to another, similarly the service core will also differ.

Hence parametric design is the process oriented to the design solution for futurism design.

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