

Fluid Forms In Architecture Form-Designing

Mahima Agrawal¹, Shradha Verma²

^{1,2} Dept of Architecture

^{1,2} Tulsiramji Gaikwad-Patil College of Architecture, Nagpur

Abstract- This paper has a main focus on the construction techniques of fluid forms, Although architecture's image of fluidity presents itself as fully manifest, its forms, the question of what fluidity designates remains unproved.

The past few years have seen increasing technological advances in building structures and materials that have more privileged properties such as flexibility, ease of configuration, elasticity, rigidity, and beauty of appearance. Hence, these facilities encourage architects to be more creative in design without fear of the difficulties that they might have to face in carrying out their designs. As a result, there is new trend in architecture which is considered as a development of modernism called de constructivism.

Architecture has main affective role in human mood, the quality of human life, and the way of perceiving the world. Not only a closed structure that holds the activities it is built for but it also should make its users calm, think, keep them „dry“ and motivate the spirit. Furthermore, architecture should be a unique thing leaving its influence in the area's life and attracting people to experience it.

Keywords- Construction Technique, fluid forms, building material, fixtures and joineries, alternative techniques.

I. INTRODUCTION

1.1 Aim

- To show the importance of fluid forms in architecture.

1.2 Objective

- To understand the importance of various forms that can be used in architecture.
- To understand fluidity in built forms.
- Techniques and materials used to construct irregular forms.

1.3 Need

- To get knowledge about the material and promote fluid forms in architecture.
- To create awareness about the techniques that can be used for making parametric forms.

1.4 Limitations

- This paper is limited to the study of fluid forms, based on Ar. ZahaHadid's concept.

1.5 Methodology

- Understanding various techniques that were used by Ar. ZahaHadid in architectural Form-making.
- Gathering secondary informative data such as: (internet, books, previous thesis done by others).
- Studying the structural systems required to construct such forms.
- To know more about materials and joineries that can help to construct fluid forms.

II. LITERATURE STUDY

2.1 Introduction

Through noting, quantifying, and tabularizing the prevailing features of project's form, it is indicated that 53 percent of Hadid's works was influenced by supremacist. While 24 percent of them were characterized by fluidity, 7 percent has organic features, 6 percent was inspired from the surface form of topography, and 10 percent was shapely designed in parametric manner.

In the earlier years of computer technology, Steven Coons (1963) already describes Computer-Aided design (CAD) as a cooperative system between the computer and the designer. In this cooperative system the creativity of the architect could be combined with the analytical power of the computer. This would then result in a more efficient way of designing.

The introduction of parametric modeling, allows the designer to explore these geometrical design variations within early stages of the design process. This technique, functions by defining various algorithms, constraints and parameters. By which fluctuation of different parameters, different design solutions can be found.

- Fluid forms have been practiced by very few architects, since it is a challenging task to erect fluid forms.

- The extensive curved geometries contribute to give its unique expression.
- Fluid forms guarantee a harmonic combination with the environment as natural forms are mostly depicting fluidity.

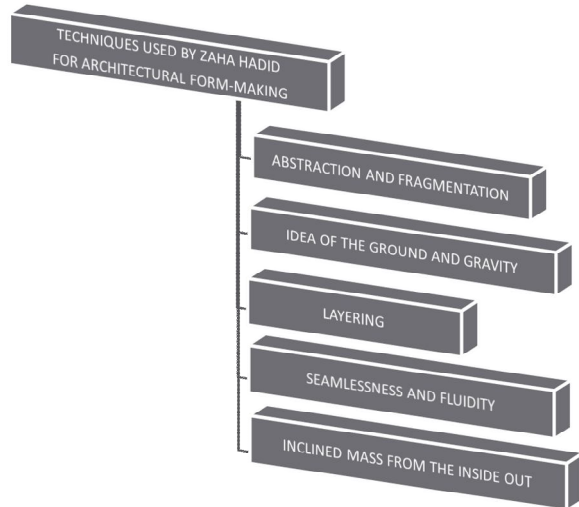


Fig .1 Techniques used by ZahaHadid for architectural Form-Making

2.2 Abstraction and Fragmentation

- Abstraction is to break the normal illustration of perceiving things and the way of dealing with it.
- Fragmentation is an application which follows the process of ‘break the block’, ‘make it porous’.
- It helps in creating organizational patterns which imply a new geometry.

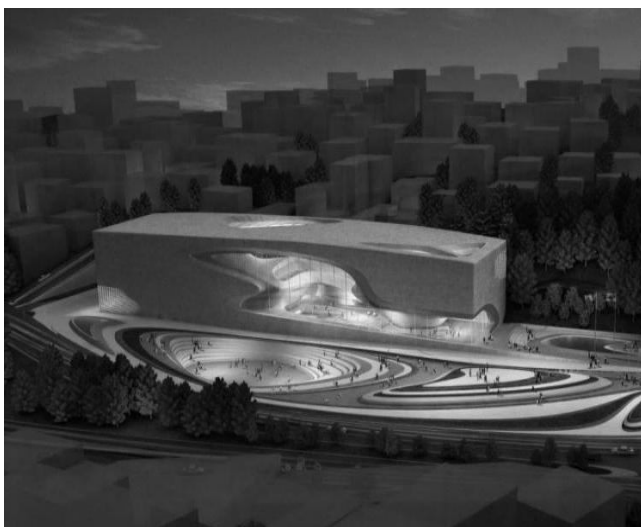


Fig .2Creative Space of Abdullah Art Cultural Center in Amman, Jordan

2.3 Idea of Ground and Gravity:

- Allowing the parts of the ground floor to be frozen by letting the parts of it stay up without any support.
- Sometimes she makes the ground porous in order to let some elements work individually.
- Use of tilted columns, fluid and inclined surfaces instead of dealing with the right angles.



Fig. 3Multi-Ground of Edifici Campus in Barcelona, Spain

2.4 Layering

- It deals with floors of the building as a separated layers or levels.
- To lightly ignore the grid of the lower floor and manipulate the ground borders.

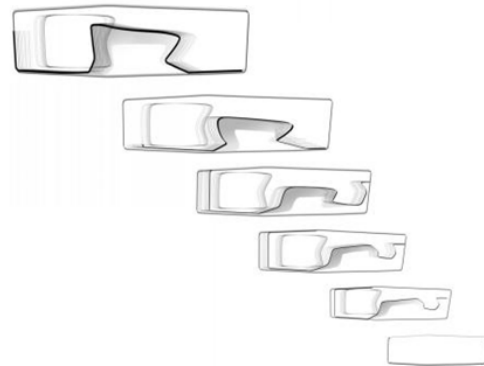


Fig. 4 Abdullah Art Cultural Center in Amman

2.5 Seamlessness and Fluidity

- Avoiding ‘I’ shape or 90 degree corners by curving the surfaces in order to give the sense of continuous fluid space.
- It allows the natural light to enter deeply throughout the building.

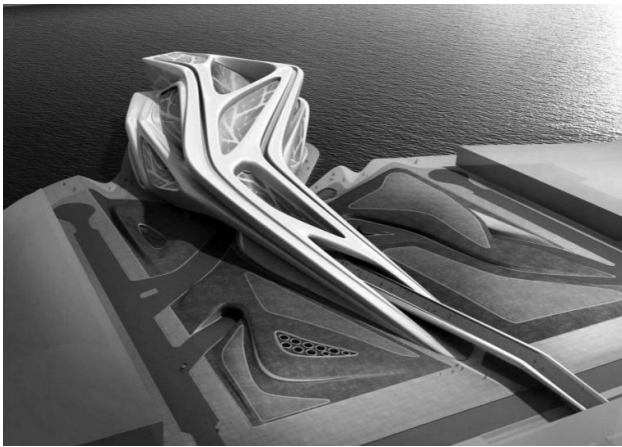


Fig. 5 Vanishing-landscaping, Abu Dhabi Performing Arts

2.6 Inclined mass from the inside out

- The variety of presenting new forms that have not been conceived before.
- One of these various ways is tilting the building to one side in a diagonal manner as if the building was pushed by a strong wind to one direction while the ground is still stick in its position.
- A diagonal design is one of the early ideas Hadid uses until now which gives the ability to conceive new space, free from right angles and corners.



Fig. 6 Creative Space of Abdullah Art Cultural Center In Amman, Jordan

III. STRUCTURAL SYSTEMS

3.1 Space Frame

- The space frame system enables the construction of a parametric structure and saves significant time throughout the construction process.
- In order to achieve large-scale column-free spaces that allows the visitor to experience the fluidity of the interior, vertical structural elements can be introduced.

- Introduction of curved 'boot columns' to achieve the fluidity of the surface from the ground to the west of the building.

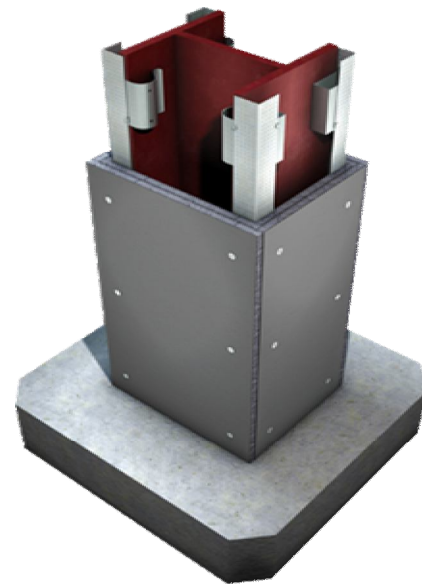
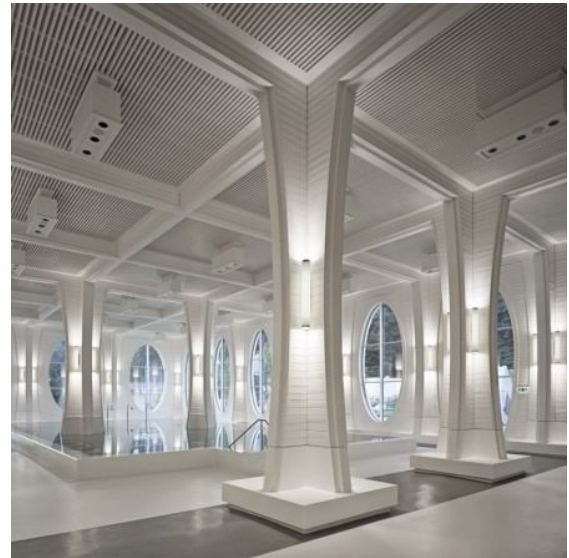


Fig. 7 Boot Column

3.2 Substructure

- The substructure can be usually developed to maintain a flexible relationship between the rigid grid of the space frame structure and the free formed exterior cladding seams.
- These seams are derived from a process of rationalizing the complex geometry, usage, and aesthetics of the project.
- In places where earthquake mostly takes place with higher magnitude, the building must be reinforced by massive 150-foot-long concrete piles buried below

the earth's surface to withstand an earthquake measuring up to magnitude 7.0.

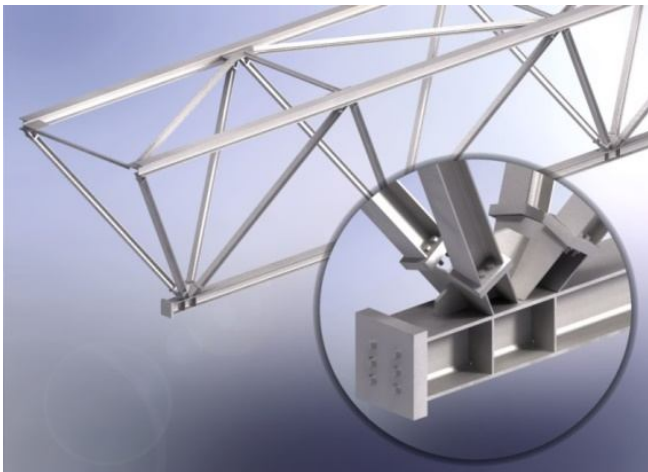


Fig. 8 Construction Joineries

3.3 Special Nodes

- The method of maintaining stability is to extend the steel core beam from the reinforced concrete core tube, fix the vertical steel member to the joist, and connect the space frame to the joist.
- The space frame will be subjected to a large bending moment.
- In order to solve this problem and ensure structural stability, the structural engineer should thicken the space grid, from the other parts of the single layer into multi-layer, to provide adequate bending resistance.

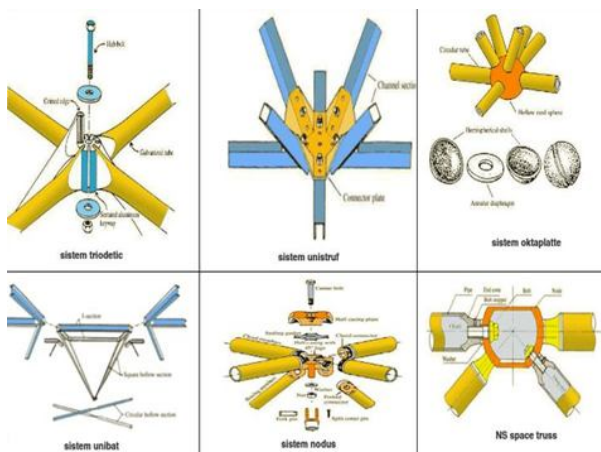


Fig.9 Joineries used in space frame

3.3 Materials

- Reinforced concrete is mainly used to construct shear walls as the partition to separate main spaces and to support the space frame.
- It also used to construct the footing of the building.
- Glass fiber reinforced plastics and glass fiber reinforced concrete panels are the predominant materials used in the façade system.
- It is a mix of reinforced concrete, steel frame structures, and composite beams and decks.
- The aluminum plate cladding system was selected because of its consistent ability to maintain exceptional smoothness and flatness.
- Most desired materials used to achieve desired seamless curves is concrete.
- Provision of an alternative proposal for the manufacture and supply of a series of 400 complex curved façade panels.
- The panels can be manufactured from fiber reinforced polymer (frp), a composite required for the external façade paneling of mobile art, the Chanel contemporary art container designed by Zaha Hadid architects.
- Using computer modeling and finite element analysis to optimize the laminate construction.
- The laminates can be toughened with a mixture of glass reinforcements.
- Including stitched biaxial cloths and unidirectional fibers with various core materials can be useful with a combination of fire retardant resins.

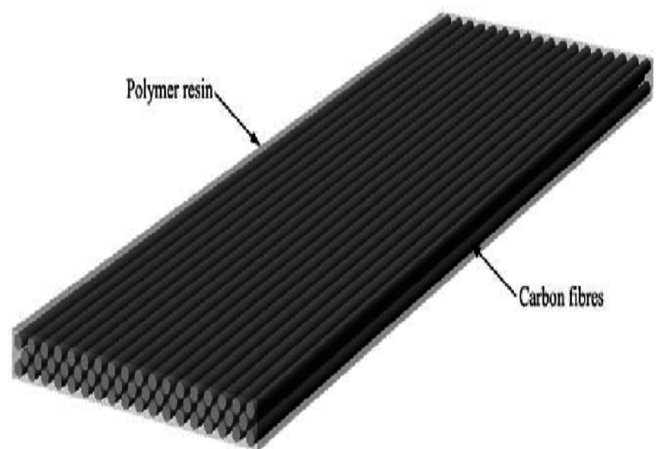


Fig.10 Reinforced Polymer

Glass Fibers Reinforced Polymer

- Glass fibers reinforced polymer is composites that have been prepared by various manufacturing technologies.

- They are widely used for various applications. Nowadays, it has been used in electronics, aviation and automobile application etc.
- Glass fibers have excellent properties like high strength, flexibility, stiffness and resistance when it comes to chemical harm.
- It may be in the form of roving's, chopped strand, yarns, fabrics and mats.
- Each type of glass fibers are unique in their own properties and are used for various applications in the form of polymer composites.
- The mechanical, thermal, water absorption and vibrational properties of various glass fiber reinforced polymer composites were observed.



Fig.11 Glass Fiber Reinforced Polymer

IV. CONCLUSION

- Curvature appears to affect our feelings and emotions, which in turn could drive our preference.
- It creates hierarchy when compared to the surrounding spaces.
- Challenging to erect but eye catching after erection.
- These iconic buildings had been commissioned by cities to generate economic growth through tourism.
- Encourage architects to release their potential talent to promote exposure in fluid forms.

V. ACKNOWLEDGMENT

With deep sense of gratitude I would like to thank all those who helped me prepare my research.

I would like to pay special regards to my guide, Prof. Vandana Khante and Prof. Shivani Chudhari for their

continuous support and guidance with encouragement, enthusiasm and immense knowledge throughout the session. I would like to thank my friend Mahima Agrawal and all of my classmates and faculty members for their continuous support in order to help me improve this research.

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