Parametric Architecture Design: An Iterative Interrelations between Implementation of Architectural Parameters and Architecture Aesthetic Theories

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Abstract– During the last few years there has been an extraordinary development in excavation of gas in the Middle East zone and there is a large trade in Middle East gas between many different countries and there is many conflicts between them because of the deals between them. Parametric design is, in a sense, a rather restricted term; it implies the use of parameters to define a form when what is actually in play is the use of relations. I will use the term in a wide sense that covers what can be found in the literature under other headings such as relational modeling or variation design or constraint-based design or other titles, so it should be a place join between these countries and arrange deals between these countries. The location of these place should be between these countries and be in one of these countries so it would be in Egypt in new Alamien city the place has a good environment, location, view, many entertainment places. the project have a parametric deign to catch up with the modern new automated architecture to make and help the members of the country to enjoy the place and take the suitable decisions, the place should provide all abilities of relief and entertainment and luxury for them the place is made to join all these countries and solve their conflicts between them.

I. Introduction

A. *Parametric design*

It is important to know how elements relate to each other, but it is not necessary to know their absolute dimensions. Parametric modeling has set the stage for the expression of elements as a set of relations that have variable dimensions. (Kilian, 2006; Araya, 2006; and Aish, 2006).

It is concluded that parametric design is defined as a design which is a rule based producing variations to maintain the dependencies and relations between them in order to introduce a fully organized controllable building forms. Parametric generative design is considered the 5th phase of the design development as shown in the following diagram Fig. 1. The parametric platform applied focuses on the assembly of components, functionality, computational and conceptual models within a design process [1].

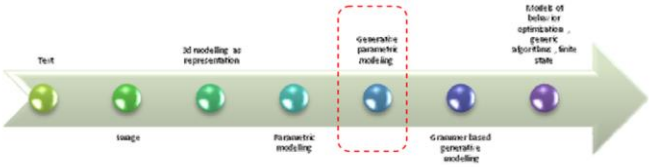

Fig.1 Generative Components

B. *Current 3D-models*

In architecture, 3D-models are elaborated by some commercial version of one of the following techniques: polygonal meshes, solid models or parametric surfaces such as nurbs. Most architectural models are still produced using the first method, together with some appropriate interface that allows the use of commands such as ‘‘3dfaces’’, polylines with ‘‘width and thickness’’ or ‘‘revsurfs’’, ‘‘tabsurfs’’, ‘‘rulesurfs’’, etc. This is due to the characteristics of architectural models that are mainly composed of planar surfaces. Many architects work with what can still can be called 2.5D-models wide lines or poly-lines depicting walls extruded to a particular height. That can be used both as drawing planes and simple 3D-models. Solid models are also widely used due to the fact that they allow boolean operations to create more complex forms. Nurbs or the like are rarely used except by Frank Gehry , as common budgets do not favor sculptured or free-form surfaces. The history of 3D geometric modeling is studied and can be found in well-known computer books like Foley’s general exposition of computer graphics or Mortenson’s more specialized textbook on geometric modeling. This justifies a much shortened summary. The intention of this summary is not only to locate the subject in the adequate context but also to stress the distance in time that has separated a published paper and a generally used technique. As we will see, this distance is approximately the same that separates the first published papers on parametric design from our immediate future, let us say 2 or 4 years. That is to say, the situation is mature for a change in the current techniques used in CAAD; it has already happened in

CAD/CAM although most of the architects that work with computers are unaware of it [2].

II. Evolution of Parametric Design Techniques

Besides the above-mentioned pioneering work of Ivan Sutherland, Hillyard and Braid 1 proposed a w x system around 1978 that allowed the specification of geometric constraints between part co-ordinates in such a way that possible variations remain restricted to a range given by some particular tolerances. This proposal was not developed in the sense that could be expected from our present point-of-view. Gossard and Light 2 mention this work as a basis for their own, which can be quoted as the primary reference for what can be called parametric design in a more mature sense. The work of Gossard and Light that will commented below as a basis for what is called variational geometry or variational design, was a major step as it provided geometrical representations with new mathematical and geometrical tools that opened the way to the generalization of a model. Around the end of the 1980s, when the main techniques of geometrical modeling, free-form surfaces and solid modeling were already assimilated, there was a growing sense that modeling techniques should advance in the direction of an increasing interactivity and ability to modify a model after it had been sketched. There were a number of important articles and books already published and, also, a few articles by researchers directly involved in the development of this field that attempted to resumethe state-of-the-art. It is clear that there are still, at the present time, two big groups, one that is becoming obsolete and the other that attracts a growing number of researchers:

1. What we can call, as Roller 7 does, variants programming or static generation of alternative models by means of a programming procedure. These systems can rely on current internal representations of models.
2. Graphic generation or interactive methods by means of more elaborated systems that allow the modification of dimension and constraints after the model has been created. These systems imply a modification or an extension of the internal representation of the model. The main disadvantage of the first group is that it cannot do what the second group does, that is, to change some of the characteristics of a model in an interactive way. On the other hand, it is a mode of work that can adapt to current CAD programs if the user has some knowledge of simple programming techniques. The main disadvantage of the second group is that we will have to wait a few years until a consistent parametric modeler, based on some of the different alternatives still under research enumerated below, is integrated in some of the programs currently used by architects[3].

III. Parametric Architecture Design Stages

A. Generative Approach

To design an office building, many criteria should be taken into consideration: 1) Number of stories, proportion of plan aspect ratio and module, 2) Form of circulation; loop, single, double corridor, radial, escape points, 3) Environmental aspects; natural lighting, ventilation, sun motion, windows openings,4) Construction grid, position and number of cores, number of office units, atrium position, services floor.

B. In the design process

Start with defining the problem first with all its aspects in order to act as the design driver afterwards. Indicate the initial shapes that will pass through generating process or will be replicated under iteration process. This procedure is achieved by indicating the initial coordinates of the basic vertices in each section composing the overall form of office building, as shown in Fig. 2.

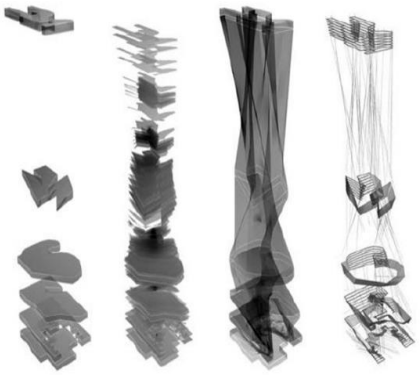

Fig.2 Vertical Transitions

B. Rule Schemata

Derive the rule schemata “parametric shape grammar to allow the lengths of lines and the angles between lines to be varied in shapes. Values are assigned to the variables in these schemata to produce specific rule” as shown in Fig. 3 which will be followed to generate the initial shapes [4].

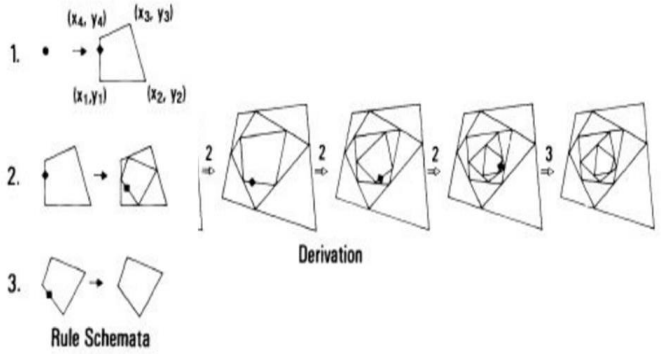

Fig.3 Generating Derivation Using Rule Schemata

C. Creation of a Relation Function Matrix

A matrix expressing the relation of functions is designed to indicate the degree of associative relationship between the functions and main components in addition to the environmental aspects. Consequently, design enters a phase of design solutions which is generated by the parametric software producing a number of alternatives that will be evaluated precisely to pick up the most suitable solution achieving the most perfect criteria. Design form and function is developed thus acquiring flexible formal progression with more uncertainty control, as shown in Fig. 4.

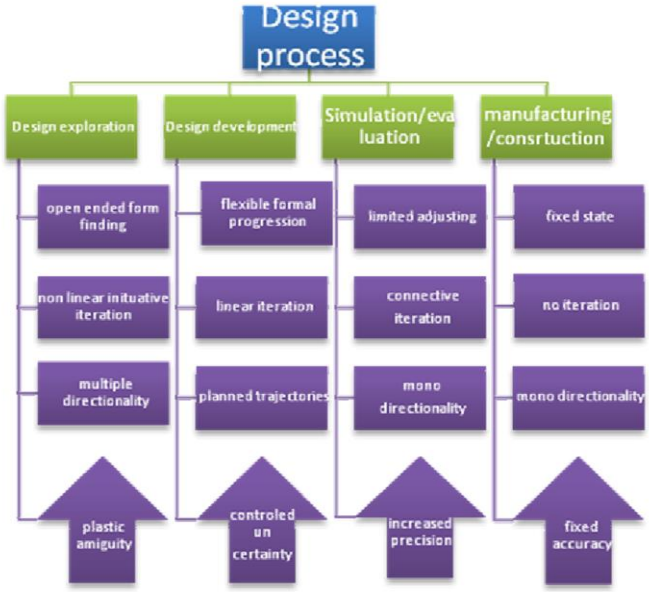

Fig.4. Generating Function Matrix

D. *Manufacturing Phase*

Finally, design reaches the manufacturing and assembly phase which was previously considered in the early stages of concept phase. At this stage, it is allowed to design double curve complex surface using different methods by cutting them in pieces , see fig (5).This will result in large collections of pieces, almost all equal, but every single one slightly different. In regular CAD this operation is extremely time-consuming [5].

IV. Office Building Architecture Design Project

Any Architecture design project has different phases to reach the final concept. This part will illustrate the aforementioned stages of designing an administrative design complex using parametric techniques.

A. *Zoning of the Project*

The project consists of various elements as follows: 1) The main entrance hall for 750 person, 2) The quarters of every country (7 countries), 3) The library, 4) The research center, 5) The administrative sector, and 6) The quarter for supervisors (2 countries).

B. *Plans*

The plans should provide the right circulation between the element of the project & each other & provide the facilities, privacy for each country to help them to take their decisions in there conflicts as shown in Fig. 5.

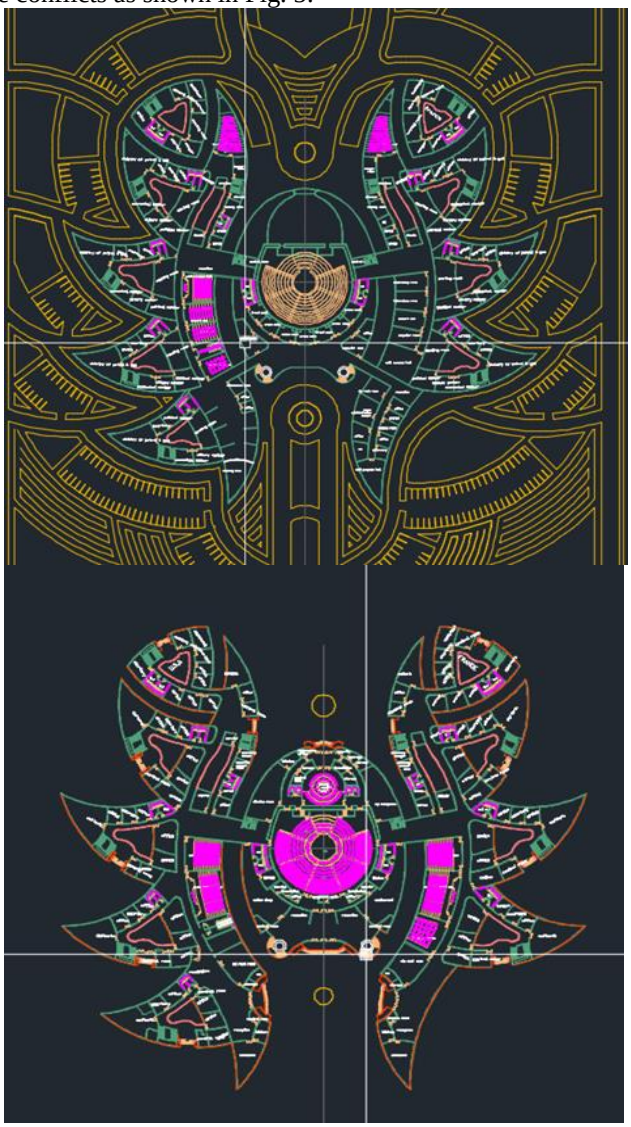

Fig.5. Plans

C. *The layout*

The layout should show the concept & purpose of the project that from the plane view the flame concept should be shown from the sky as it is very sensitive place not available for every one as it combine between many nations & many renaissance, The aluminum cladding is used as double skin material for the project combined with using some of curtain glass wall. As illustrated in Fig. 6.

Fig.6. Layout

D. Facades

The main façade should be very clear and give the sense of the main element in the project without asking people where the main entrance is as in Fig.7. The side view should also give a sense of relief should also use the technology of providing healthy daylight without glare inside the building & without making the green house effect inside the building according to the orientation of the building as shown in Fig.8.

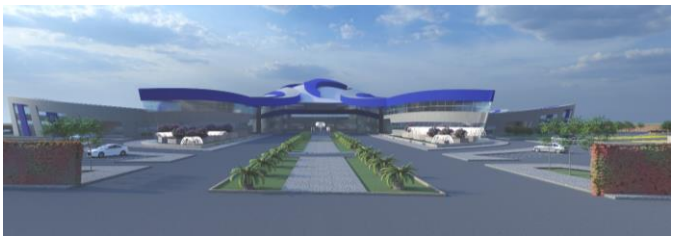

Fig.7. Front Elevation and Entrance

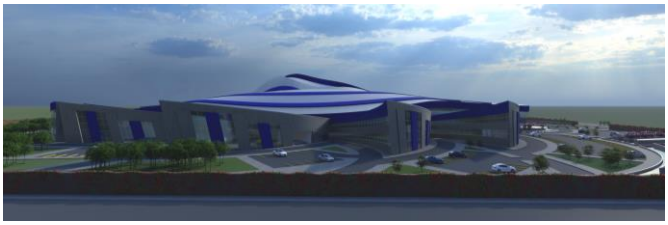

Fig.8. Side Elevation

E. The vegetation & landscape

There should be vegetation inside & outside the building to improve the environment, temperature degree, and the humidity inside & outside the building.

IV. Conclusion

In the last few decade the computer graphics and the manufacturing process have significantly developed, which impose a high opportunities and potentials to design and excute evolutionary buildings' shapes and magnificent forms. This opportunities become handy in parametric design concepts that passes through various stages to reach the fnal concept of the architecture design project. Several elements should be taken in consideration when dealing wit tha architecture design project and should be linked efficiently when using parametric design concepts. These elements are layout, plans, elevations and layout vegetation.

References

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