Software Engineering and Its Role in the Study of Office Space

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Abstract

The paper deals with the domain of engineering software and its role in office space study based on the concrete concept and definitions related to engineering programming. Starting from its inception, the stages of successive development, up to the classification of the software depending on the nature of employment. In addition, the paper reviews the most important advantages of this software in the field of engineering work. Furthermore, the paper demonstrates the role of the software in the office space study. Besides that, it clarifies the architect's mechanism in the preparation process of the various computer-based architectural engineering studies. In the field of office spaces, a case study in the city of Aleppo shows the stages of work followed in the preparation of all the engineering studies using this software.
Keywords: software, space, office.

1. Introduction:

The recent decades had witnessed growth in the role of engineering programming and its rapid development in all fields of engineering. This was clearly expressed in the different applications of this engineering software (engineering drawing, design, analysis, illustration and engineering rendering). Consequently, we can summarize the topics of this paper in the following points:

I. The engineering software and its role:

The first aim is to investigate the clear shortage of the current engineering solutions besides the misunderstanding of the engineering software itself. In addition, the paper sheds the light on the rigid-nature of the solutions provided by architects. Moreover, it clarifies the disadvantages of the transformation of the architect's role from a creative designer to a drawing tool which is limited by the characteristics of the utilized software.

II. The architect's mechanisms in submitting the engineering studies programmatically:

The second aim is to focus on the lack of an architectural methodology to determine the nature of the studied work which produced from different software. Furthermore, is to address the urgent need for a practical mechanism to be implemented by architects throughout the different stages of his study of architectural spaces in general and office spaces in particular. This action will lead to an increased interest in engineering studies which meets the real demand of adapting the engineering software in an industrial field. These aims will be achieved by drawing a clear methodology for architect's work in the early stages of his software study of an office space.

2. Research Methodology:

This research deals with the domain of engineering software and its role in the office spaces study through three studies. The first one is a theoretical study, which deals with the

definition of engineering software. It also demonstrates the most important software, types, and features used globally considering the proper mechanisms of work. The second one is analytical study, which analyzes an example of office space study in Aleppo city with the presentation of the work stages in utilizing this software. The third one is deductive study, which draws conclusions and introduces recommendations.

3. Definitions:

The concept of engineering programming in general and other software were closely related to the emergence of the computer. It was also related to what followed that from the successive stages of evolution such as the revolution of information and digital. Not long ago, the architectural software as a part of the engineering software began to emerge. Rapidly, it started to play a distinguished role in different levels of consulting and industry. For this reason, and to better understand the main role of this software in the engineering fields, we should be aware of its main definitions and concepts such as (EP) and (CAD). [1]

3.1 Engineering Programming (EP):

In a general definition, it is a series of stages applied to the computer (inputs) to create drawing or study. Another definition is a complete description of a certain concept for the purpose of manufacturing or construction (outputs). This process would be achieved through several mechanisms described as simulation or azimuthal (optimization) and others.

3.2 Computer Aided Design (CAD):

It is a system that allows the use of computer capabilities and its applications to create a design or develop a product (architectural, industrial or other). This process only represents the concepts without manufacturing. It mainly relies on a processor, a central memory with a graphical system. Most of the software in this system contain reference libraries that include different components, and architectural elements to facilitate input and output processes. Nonetheless, we should be aware that CAAD (Computer Aided Architectural Design) is the most reliable engineering system which contains digital inputs used in this domain.

3.3 Engineering software types and features:

The number of software used in the field of engineering has increased significantly. This was a result of its rapid development, diversification of its functions, variety of its developing companies, and the degree of modernization applied to them. Here we mainly direct the compass to the engineering software that is applied in the field of architecture. It has proven a real competence and effectiveness in supporting various studies and designs. This software can be categorized in terms of the nature of implementation by an architect or designer for the two main types as shown in Figure (1). [3]
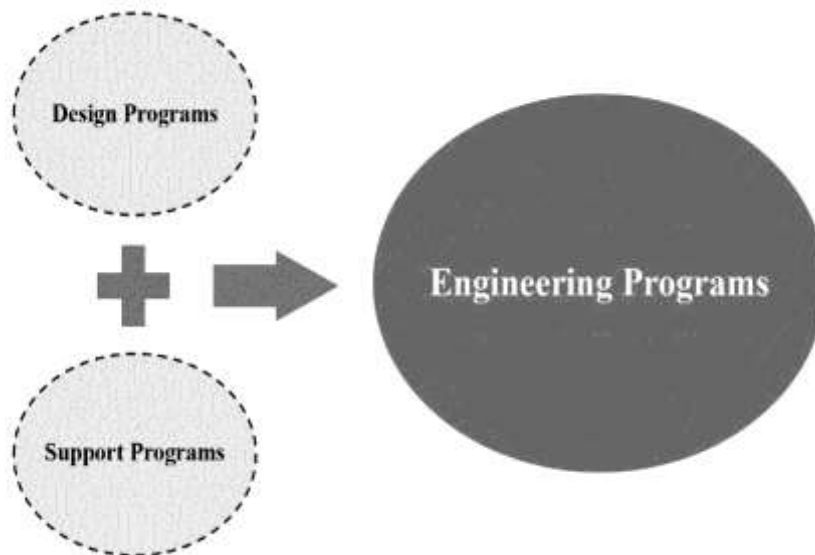
Figure 1. Functional classification of engineering software.

I. Design Software: means all software whose systems provide an explicit engineering product (design or industrial). The most important design software used globally in architectural field is shown in Table (1). [2]

Table 1. The most design programs used globally.

Different Design Software		Autodesk Design Software Package	
1	ArchiCAD LD	1	Autodesk AutoCAD (Etc.)
2	Rhino Ceros	2	Autodesk Revit
3	Vector Works	3	Autodesk Spline Land
4	Sketch Up Pro	4	Autodesk 3DS Studio Max
5	Thea 3D	5	Autodesk Maya 3DS
6	Cinema 4D	6	Autodesk Ecotect Analysis
…. Etc.		…. Etc.	

II. Supporting Software: whose systems support the engineering studies provided by the design software mentioned above. It is intended to support the presentation, presentation, analysis and data analysis of the data. The most important supporting software used globally in the architectural field is illustrated in Table (2). [2]

Table 2. The most supporting programs used globally.

Different Supporting Software		Microsoft Office Package	
1	Adobe Photoshop	1	Microsoft Word
2	Corel Draw	2	Microsoft Excel
3	Google Earth	3	Autodesk Access
4	Atlantis	**Viewer Package**	
5	GIS System	1	Picasa & ACD See Pro
6	SPSS Data Entry	2	Adobe Reader
…. Etc.		…. Etc.	

4. The role of engineering software in studying office space:

The engineering software plays a major role in the internal study and evaluation of spaces. This role should be in the terms of functionality and the size of required details. It is crucial to bring the architect's attention to the limits of the software role. The design software is no more than a tool by the architect hand to present his concepts in an appropriate engineering way. It is not a substitute for design, creativity and analysis, but is actually acting as a mirror reflecting his manual lines and ideas.

4.1 The mechanism of the work of the architect in preparing the study programmatically:

The mechanism of an architect work at the software level means the practical methodology used in the preparation of engineering studies provided on the computer. The nature of applied work and the precise choice of appropriate software are the main factors to be considered. Recently, the mechanisms of software engineering study have developed significantly to meet the demand of architectural design development and its programs. The qualitative transfer of CAD mechanism and its software to ADV mechanism, as shown in Figure 2. [2]

Figure 2. The evolution of the architect's work mechanisms programmatically.

In the programmatical study of an office space, the architect can employ a variety of specialized engineering software to achieve all the functions he initially sketched. Figure (3) illustrates the software workflow of the architect during the stages of his study of a certain space. [4]
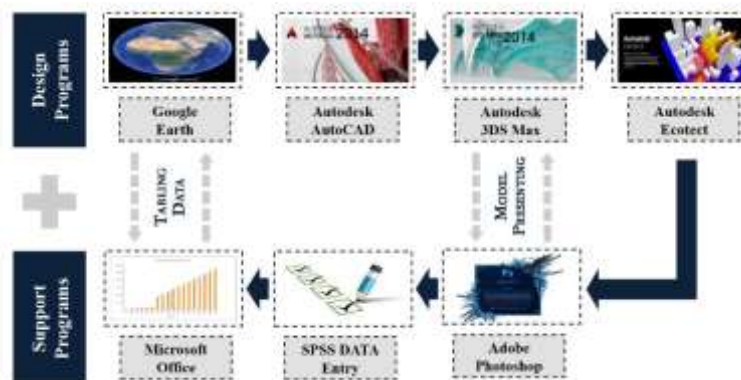

Figure 3. The sequence of architectural work with specialized software in the study of office space.

5. A case study of an office space study using engineering software:

The architectural study of office spaces within Aleppo municipal palace building goes through several stages. We can shortly explain these stages with the utilized software as the following:

• *General architectural description and drawing the current situation of the office building:* Here, Google Earth can be used to determine the location, as shown in Figure (4).

Figure 4. Aerial and field imagery via Google Earth for the site of the Municipal Palace Building.

It is also possible to rely on the software (AutoCAD) in drawing the current situation of the office tower with dimensions, openings, and all architectural details, as shown in Figure (5).

Figure 5. Draw the current situation of the palace tower spaces depending on AutoCAD software.

• *Simulation of all interior and exterior architectural elements:* Autodesk 3DS Max, or Autodesk Revit to can be used to model all office tower spaces, as shown in Figure (6). [5]
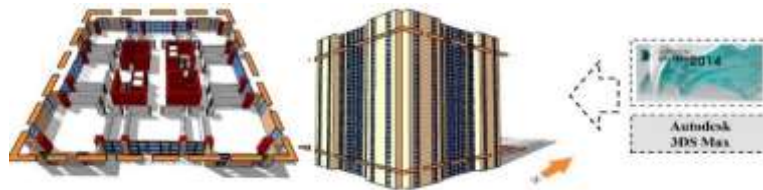

Figure 6. Modeling the Municipal Palace Tower using Autodesk 3DS Max software.

• *Office spaces analysis:* All existing spaces are shown after a cutaway plane. Adobe Photoshop can support in color highlighting for the occupied functions, as shown in Figure (7).
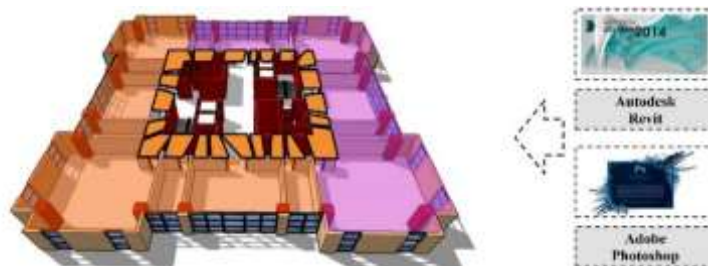

Figure 7. Spread the tower spaces using the Autodesk 3DS Max and Adobe Photoshop software.

• *Physical conditions analysis of the office spaces:* By utilizing the capabilities of Autodesk Ecotect Analysis, architects can assess nearly all the conditions of the studied space. Natural

lighting, artificial lighting, ventilation, shadow masks, reflections, and thermal comfort, as shown in Figure (8). [3]
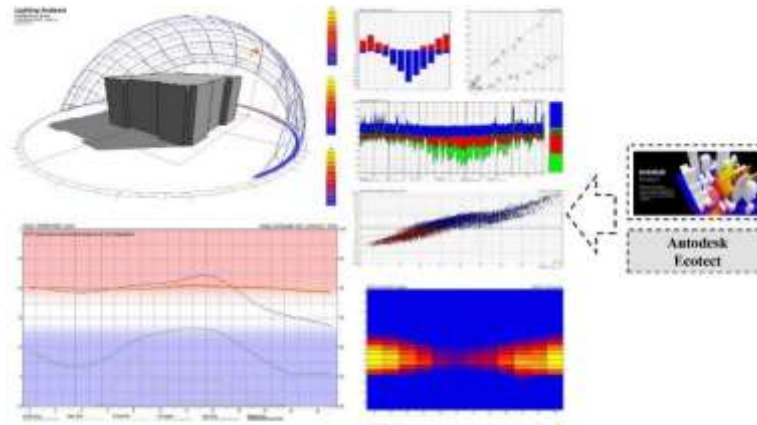

Figure 8. Schedules and tables from Autodesk Ecotect software.

▪ *Survey of Building Users and Professionals:* Using SPSS Data Entry, a questionnaire could be organized about the internal space requirements, as shown in Figure (9). [4]

Figure 9. Survey of the specialists views in the study of office spaces via SPSS Data Entry.

6. Discussion and results:

Engineering programming has passed several stages since its inception, from Sketch Pad the first software in 1963 to the latest global engineering software from Autodesk Inc. today. Engineering programming includes all the processes applied to the computer in the field of engineering, depending on inputs to reach the outputs of engineering during a series of interrelated stages of study and analysis. Moreover, The software used in the engineering field is classified according to the nature of implementation by the designer which takes several geometric images, and software type that supports his mechanism of providing and analyzing the study. For this reason, the real knowledge of the utilized software features and techniques ensure proper transition of the study between several consecutive programs, and accuracy in the work applied with complete fulfillment of the engineering requirements. The engineering work mechanism (ADV) was conceived as a developed concept of the mechanism of work (BIM). It called for simulation of the studied space through its modeling and presentation in a three-dimensional format.

7. Recommendations and proposals:

Based on the discussions above, An architect should deal with design software as a tool in his hand, to present his concepts and proposals. This is the fundamental difference between the role of the architect and the role of the software. In addition, the necessity of linking the architect to the characteristics and features of the software employed in his study of the office space with the nature of the engineering work to be applied. It is important to ensure the proper sequence of the work of the architectural program during the stages of engineering study, such as moving from the use of design software to support one. It is essential that the architectural study of an office space go through several stages, from the general architectural description, modeling, and analyzing the internal spaces and its elements. Architects should take advantage of the sophisticated features of the Autodesk Revit software in the formation, modeling and deployment of architectural spaces, to evaluate, analyze and study office spaces, and to select appropriate supporting software to express the overall functions, internal movement and furnishing. It is important to utilize the characteristics of Autodesk Ecotect Analysis in the assessment and study of the conditions of the physical architectural space of natural and artificial lighting, ventilation and thermal comfort.

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