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## Investigation about the feasibility and impediments of TRIZ application in architectural design process

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### Abstract

Research about new methods in architectural design process can expand design researches. Structured design methods can make design more learnable and teachable. This study is an attempt to draw a framework for research about application of TRIZ theory in architecture in terms of wicked or ill-defined problems.

This investigation reflects the applications of basic concepts and theoretical foundations of TRIZ such as technical systems, ideality, evolution of systems, contradictions, Su-field and ARIZ algorithm in architecture. For spatial configuration, redefining parameters and principles is proposed. We concluded that further concepts of ideality and levels of innovation should be defined specifically for architecture.

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### 1. Introduction

Creativity is ubiquitous in all areas of science, art, and culture. Since architecture is a combination of art and technology, the study of the creativity subject is somewhat more complex than in other fields. The most influential architects in architectural history did not tend to talk about the design process and idea formation in their minds. Historically, while the discussions and debates about creativity after the destructions by World War II- in order to increase production quantity and quality for nations- had started in the late 1950s, architects were away these meetings

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and conferences. So, addressing the issue of creativity in architecture and research about architectural design started later than in other fields [1]. Research on organized and algorithmic methods and creativity in architectural design has been addressed in recent years in some universities around the world. Like in any other field also in architectural process, the more organized process the more teachable and learnable. Furthermore, by making the design process more structured, the evaluation of design will be easier. Considering different interconnected factors influencing the architecture design such as the client, society, culture, space, form, aesthetics and technology, précising definition of the problem in the architecture seems too complex.

Research about the application of TRIZ theory (theory of inventive problem solving method) in the architecture has attracted less attention than in other disciplines. Mann [2] explains the results of training TRIZ to students by four samples of student works. In his earlier research, he was trying to find specified examples for 40 TRIZ principles in architecture [3]. In another research [4], he emphasize more on foundations of TRIZ such as contradiction, Ideality, function and using resources. He also has used four design problems including window, ramp lifetime home and staying warm. He also explained TRIZ theory mainly deals with the topic of evolution [5].

Salamatov [6] outlined five-level innovation in the art. Ruy-Sen [7] has investigated about TRIZ application for the improvement of heat insulation for roof steel plates. The author has tested his theories by experimental method, creating examples and measuring the temperature inside and outside. Kankey [8] has discussed about improving the acoustics in a historic building by using TRIZ. The author has used a theoretical approach to study the subject. Padmanabhan [9] has stated and solved the problem of increasing wind power in buildings using TRIZ Tool in urban areas by an experimental method. Rantanen [10] has tried to explain the concept of accessibility in houses by 40 principle of TRIZ. Other authors have analyzed construction inventive patterns based on TRIZ method [11] and Chang [12] has studied emergent problem-solving in construction with TRIZ. Hamed [13] in his research report has scrutinized key concepts of TRIZ: Contradiction, Resources, Ideality, Patterns of evolution, Innovative principles. He has investigated the design process of some examples such as mosquito trap and an automatic seeding machine. He has studied all mentioned concepts in several design fields [13].

Basically, previous studies conducted in the subject matter of TRIZ application in architecture, are divided into several categories: A - Architectural design; B – Design; C - Design of building components (e.g. doors, windows, ramps); D - Solving specific problems in buildings (e.g. isolation, wind affects, acoustic); E - Devising new methods in the construction process.

The references about the feasibility of TRIZ application's in architecture can be divided into four categories: 1) design process and architectural design methods; 2) TRIZ theory, history, applications and evolution of TRIZ theory; 3) architectural design and TRIZ applications in the arts; 4) evolutionary history of architecture spaces and buildings.

The motivation of this study was examining application of an inventive problem solving method in architectural design and estimates its probable advantages in comparison with other design methods as well as organized architectural design methods. Research about creativity in the field of architecture and architectural design process and methods are relatively new, however, it is a challenging and controversial area. Architectural designers have designed in highly different ways. Even the methods of architectural design throughout history have undergone many variations. The application of a theory that has been produced in other areas in the architecture is highly controversial. Most of the design methods used in architecture were born inside the field. Architecture has its unique features and qualities. Unlike other products, architecture users just do not simply use it, but they live and work inside of it and interact with it. The concept of space in architecture considering its psychological attributes makes it a more complex issue. Form and function are just two needed factors for building among many factors.

This study aims to investigate the feasibility and impediments of TRIZ application in the architectural design process. The few researchers of TRIZ application in architecture have focused on finding case examples for 40 principles instead of dealing with TRIZ theoretical foundations. This work will reflect about some questions: is TRIZ an appropriate approach and method for architectural design or not? What obstacles and problems will occur within the application of this method in architecture? How can the contradiction matrix and engineering parameters and 40 principles be applicable in architecture? Considering the special characteristics of the architectural parameters, are the 39 engineering parameters directly applicable or should be defined and developed architecture-specific parameters? How architectural problems should be considered to be solvable by TRIZ method? How should be considered the

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