IP: Structural Architectures – Geometry, Code and Design

PROJECT OBJECTIVES AND INNOVATIVE CHARACTER

- Explain the rationale of and background to the project (current situation, previous or preparatory work, the results of any needs analysis undertaken, etc.). You may attach appropriate but succinct supporting documents.
- Define the concrete aims and objectives of the project and describe the ways in which the situation and needs set out above will be addressed and changed by the project.
- Show how the IP ties in with the existing teaching programmes of the participating institutions and describe explicitly what you consider to be **innovative** about the project, in particular in relation to defining or building a European dimension in the topic addressed.
- Please show the expected learning outcomes.
- [Maximum 2 pages/60 lines]

The background of the IP "Structural Architectures – Geometry, Code and Design" was a Symposium at TU Kaiserslautern, Germany in June 2010. The Symposium focused on approaches by structural thinking in architecture, proposing to critically analyse some of its original philosophic and operational aspects and to compare them with the present idea of architecture, considering the present role of the digital means. This was at the same time in order to identify the structuralist heritage in our architectural culture, and in order to draw prospective updated guidelines in the field of architectonic research, teaching and learning activities. In the year before, colleagues from Kaiserslautern and Zürich met at the Symposium "Structuralism reloaded?" in Munich and discussed their research on the topic structuralism respectively structural thinking in architecture. At the Symposium in Kaiserslautern we started the multilateral discourse on this topic with the partners in Kaiserslautern, Madrid, Milano and Zürich. Cornelie Leopold from TU Kaiserslautern brought in here background from Geometry and Philosophy. Luigi Cocchiarella from Politecnico di Milano focused in his contribution on a semiotic view on Graphics in relation to Architecture. Mayka García Hípola from Universidad CEU San Pablo Madrid referred to designing in structures. Benjamin Dillenburger from ETH Zürich reported on his project to develop a topological database for architectural floor plans. (http://www.uni-kl.de/AG-Leopold/dg/forschung/strukturen.html)
On this common background of structural thinking in architecture grew the idea of developing a summer school for students, where the different aspects could be experienced, related to each other and applied to architectural projects. The research results should be beneficial for teaching. The analyses of existing architectural design programs showed that there exist historical reviews of architectural structuralism in refer to approaches in anthropology and other human sciences, but not in refer to structuralism based on mathematical structural thinking as there had been also approaches in the 60s, especially developed at HfG Ulm. On the other hand, there exist approaches in parametric design with digital tools in architecture, but there is a lack of interlocking the mathematical structural thinking with the rule-based design in architecture in this historical tradition. The IP gives the chance for such an innovative approach in teaching architecture. The IP brings together the various disciplines, "visual" and "non-visual", which remain mainly separate in the participating universities, under the common theoretical background of structural thinking and ties the disciplines in practical use for design projects. One of the main goals of our project is to emphasize and to test the ways by means of which the various parameters involved in architecture gradually "coagulate" in a significant geometrical configuration during the design process. In this process, the passage from non-visual to visual codes is decisive. Architectural education in Europe has different traditions. Approaches in architectural design as well as the roles of various codes and representation techniques are varying in Europe. Bringing together the different traditions and approaches, mediating between them and picking out various codes representing structures in architecture in the IP means a crucial point in building a European dimension in architectural education.
This IP program ties with the existing teaching programs of the four participating universities. The IP will target students with basic knowledge in the Geometry, Graphics, Structural and Architectural Design as well as Computer-Aided Architectural Design during their forth year of studies or later (BA, MA or Diploma).

The structural approach in architecture will focus on theoretical foundations and design methodologies. The interaction of the different disciplines is the most innovative aspect of our IP. Different spatial scales, from interior to landscape, and different codes and visual means, analogue and digital, will be considered to achieve an understanding for the universal claim of structural thinking. To get theory and praxis closer, concepts of module and cell will be studied in examples of architecture. Some selected case studies will be proposed to the students, including both spontaneous and planned habitats (i.e. in the Mediterranean area), in order to detect the connections between elements and systems, and the connections among spatial configurations,

their qualities and symbolic meanings.

A design exercise called "Macrostructure and Microstructure" will be developed. In it the cell, its series, repetition and transformations will be studied from a design point of view according to mathematical and digital approaches, following a process from the specific to the general. Highly different generators may be the starting point for the design (topography, light, density, communications, orientations). The objective of this part is to fully develop the spatiality of a cell and the study of its repetition and growth to understand how series evolves from the repetition of a conceptual module and development of a complete project studying a new typology based on the analytical study of the repetition/transformation of a basic unit within a complex urban setting.

In order to study the design process, the activities will be focused on the relationships between real structures, theoretical structures and graphic structures in architecture, and on how to translate one into the others. Codes for their representation, especially graphic representations will be applied for architectural design.

Digital tools will permeate the structure exercises in order to explore the new actuality of structural approaches. The series of workshops will be engaged with the question of permeability of the threshold between the physical and the digital realm. Such permeability is procreated by an exchange of data which itself is dependent on the formalization of inherent geometric relationships between different elements of the design. In the workshops this process of structuring will be explored in more detail with focus on the behavior of materials, hierarchies and organizational principles within material systems. This inherent ability of materials to 'compute' will be explored through experiments and combined with digital design methods in order to investigate patterns of organization in space and the architectural utilization of these patterns by means of parametric and geometric variation.

The IP is planned for three years, first year in Milano, second year in Kaiserslautern and third year in Madrid. The results from the first year will influence the focus of the project in the following years. In the first year the approaches will be varied and compared. In the following two years there will be a focus to the most promising and innovative approaches.

In the IP the professors and the students learn how to cooperate in a multidisciplinary and international group for a joined project in using structural thinking for architectural design. Starting from the first Structuralism and from the subsequent experiences up to the present architectural culture, aiming to reach a more updated methodology, the students learn how to use and formulate precisely rules for architectural design, to transfer them in codes for their representation and to apply them with analogue and digital tools in the design processes. During the working processes they learn how to use effectively ICT-based tools for common content and communicating in the international group especially in the preparing and post-processing time.