

## ABSTRACT

The research activity of the candidate started in December 1999, when he was recruited as PhD student at the Politehnica University of Timisoara under the coordination of Professor Valeriu Stoian. His PhD thesis entitled Using the FRP Composite Materials for Strengthening Brick Masonry and Reinforced Concrete Elements was defended at the Politehnica University of Timisoara in July 2004, with the distinction of Magna Cum Laude. The present thesis summarizes a part of the research activity of the candidate after this data.

The selected post-doctoral activity considered to be relevant and original was developed within the main thematic direction of Structural Strengthening using FRP Composites, presented in Chapter 2. A second direction was also considered, entitled Structural Health Monitoring of Energy Efficient Buildings, presented in Chapter 3.

Through the years the candidate was member in 11 national and 5 international research grant or program, in 4 as coordinator. The main researches was in the field of Structural Strengthening using FRP Composites (13 grants), while in the last 3 years interest was shifted towards to the Structural Health Monitoring and Energy Efficiency of structures.

Continuing the main theme of the PhD thesis the candidate won by competition a research grant offered by the Romanian Ministry of Education (title : Advanced systems for strengthening reinforced concrete structural elements as beams, columns, walls and slabs using fiber reinforced polymer composites - CEEX program). In the frame of the project new and innovative anchorage systems and strengthening technologies for reinforced concrete beams were developed, the confining effect of carbon and glass fiber reinforced polymers (FRP) and their superposition with the application of innovative near surface mounted (NSM) steel and FRP bars were studied. Another focus of the project was represented by the study of the influence of various sized cut out openings created in structural walls and slabs retrofitted using externally bonded and NSM FRP composites.

In parallel, the subject of advanced techniques used for structural strengthening of masonry elements was also studied in a CNCSIS as well as in a frame of a European FP6 project called ProHiTech - Earthquake PROtection of HIstorical buildings by reversible mixed TECHnologies. As main results, the stiffening effect of different retrofitting systems was evaluated, the efficiency of solutions was categorized in terms of resistance, ductility and costs, and a new strengthening solution was proposed and investigated, based on a new concept of steel wire mesh applied with epoxy resins.

The accumulated knowledge in the field of retrofitting, permitted to use and apply the FRP strengthening methods even in the field of steel-concrete composite walls, which was investigated in the frame of the project entitled Innovative structural systems of composite steel-concrete materials and polymer composites, project type PN II. One of the most promising results of the experimental program was a further development of an anchorage system used for FRP lamelas subjected to bending superposed with a confinement FRP fabric.

Later on, the investigation of full scale precast prestressed concrete element support zone was studied and the strengthening possibilities were analysed. Based on the initial nonlinear modelling, the strengthening strategy was determined and an experimental test was designed.

The experimental part was followed by a numerical calibration and by an extension of the strengthening matrix.

The second subject of research covered by the candidate is related to the Structural Health Monitoring of Energy Efficient Buildings, in order to validate design principles, to evaluate real energy demands and to optimize and reduce energy consumptions. This field is time dependent, because it is based on recorded parameters throughout several years. The research in this field started in 2012 through PASSHOUSE (Performance ASSESSment of energy efficient HOUSEs Through Monitoring) program, financed by the European Regional Development Fund, and continued with a PN II program, entitled Nearly Zero Energy Building and Passive House - sustainable solutions for residential buildings. In these projects, the objectives were to conceive, realize and put in function a complex monitoring system, to collect data from internal and external parameters and finally to provide a practice guide based on the results.

It must be mentioned, that all the above mentioned research was performed in cooperation with the PhD students within the Department of Civil Engineering and Building Services from Politehnica University of Timisoara.

The candidate is member of important scientific associations in the field of structural engineering, such as American Concrete Institute (ACI) and International Federation for Structural Concrete (*fib*). The candidate published a series of books in the fields of structural use FRP composites in constructions for practical use of designers and researchers, as well as several design guides addressed especially to students in many subjects.

The involvement of the candidate in several national and international grants as director or team member developed abilities and competences on management of such projects. It has to be mentioned that the candidate already guided four doctoral students for obtaining their Ph.D. degree at the Politehnica University of Timisoara. He is an active member on two ongoing project, one in the field of energy efficiency and monitoring (the above mentioned PN II project) and the second in the field of FRP in construction, in the frame of COST Action TU1207, entitled Next Generation Design Guidelines for Composites in Construction.

The relevance of the scientific activity and the recognition of the national and international activity in the field of the Structural strengthening using FRP is emphasised by the publications of the candidate, several of them in cooperation with recognized European and US researchers. The fact that all the problems were investigated through a theoretical approach, with numerical simulations, as well as in an experimental part, through several real, large or reduced scale elements, raises the real value of the performed studies and research projects.