HABILITATION THESIS

(a) ABSTRACT

The present thesis summarises the research of my activity, after the PhD thesis was defended at the Politehnica University of Timişoara and confirmed by the Ministry of Education and Research, on the basis of Order no. 3896 / 24. 04. 2003.

The habilitation thesis presents two main research activities that I performed and omits a series of activities considered secondary and complementary to the main ones.

My first research area consists in theoretical and experimental studies regarding the behaviour of steel composite elements for buildings placed in seismic areas.

This PhD research domain was further studied and supplemented with the discovery and the use of innovative composite solutions.

It is worth mentioning that my activity in the field of steel composite elements, continues a research domain from the *Civil Engineering Department*, initiated by: Prof. PhD. Eng. Constantin Avram, corresponding Member of Academy, Prof. Ph. D. Eng. Valentin Bota, Associate Prof. Ph. D. Agneta Tudor and the researcher Ph. D. Liana Bob; the last two persons mentioned being also the authors of the Romanian Code for the Design of Steel Concrete Composite Elements.

The second research area is focused on monitoring the structural health of special constructions or highly important buildings, on monitoring certain constructions in order to validate certain calculus principles. Within this research I have studied various applicative construction issues, i.e.: the subjects approached are closely connected to the execution activity and to the monitoring of the buildings behaviour in time. Therefore, I have applied new concepts for the energetic efficient buildings, as regards their construction and monitoring in order to validate the energetic performances.

Consequently, during the post PhD thesis period, my research activity and the results of the activities developed led to the discovery of certain innovative elements in the field of construction.

I am going to present some of my main contributions and professional achievements for each research field:

- Developing a theoretical and experimental study on composite joints for buildings under asymmetrical loads, real scale 1:1;
- Proposing new innovative solutions for shear walls with steel encased profiles, as alternative solution for high rise buildings placed in seismic areas;
- Performing theoretical and experimental studies regarding the behaviour of the steel concrete composite walls with steel encased profiles. Presenting the results by comparing the new proposed solution with the classical one;
- Retrofitting of damaged composite steel concrete walls using CFRP, testing and validating the proposed solutions for the structural rehabilitation of shear walls affected by earthquake;
- Monitoring the constructional structural works of “Commercial Centre Iulius Mall Timişoara”;
- Structural health monitoring of two chimneys from the Rovinari power plant;
- Promoting the concepts of Passive House and Nearly Zero Energy Buildings as possible solution for sustainable buildings in temperate climate and proposing a monitoring system to validate the above mentioned concept.

I intend to continue the research on the above mentioned fields as follows.

In the field of *the behaviour of steel concrete composite shear walls with high strength concrete* I aim to:

- Identify innovative solutions for composite steel-concrete shear walls with partially encased profiles, for solid composite walls and with various configurations of openings;
- Find new technologies to make shear walls using fibre reinforced concrete;
- Strengthen composite shear walls using Fiber Reinforced Polymers as possible strengthening solutions for structural elements damaged under seismic events.

In the field of *monitoring the structural health of special constructions or highly important buildings and monitoring certain constructions in order to validate certain calculus principles* I plan to:

- Find efficient solutions for sustainable buildings in Romania
- Finish the research programme of monitoring the passive house and nearly energy building;
- Provide a practice guide based on recorded data.

After finishing PhD Thesis, in the mentioned fields, I was an active participant in the research programme FP6 PROHITECH "Earthquake Protection of Historical buildings by reversible mixed Technologies" and COST C25 action: "Sustainability of Constructions-Integrated Approach to Life-time Structural Engineering"; these are research themes complementary to my main fields of interests.

It is worth mentioning that the results obtained within the frame of the first research area, i.e.: the field of steel concrete composite elements, were obtained during the project PN II IDEI 1004/2008, contract 621/2009, financed by CNCSIS –UEFISCDI (2009-2012) which I coordinated. I acknowledge the financial support received for the research.

The studies and research activities in the field of energy efficiency of the buildings are under implementation in the project PN-II-PT-PCCA-2011-3.2-1214 contract no: 74/2012, entitled "Nearly Zero Energy Building and Passive House - sustainable solutions for residential buildings" financed by UEFISCDI. I have to mention that I am the coordinator of this research program, too.