

**Shape Memory Alloys Engineered from the Macro to the Nano Realm**  
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**Abstract:** The Habilitation Thesis “Shape Memory Alloys Engineered from the Macro to the Nano Realm” reflects the activity of the author, performed between 1997 and 2012, on the development of shape memory alloys. It is based on original contributions performed during research activities financed by “Politehnica” University of Timisoara, University of Maryland at College Park, Centre for European Studies and Research Bonn and Universidade Nova de Lisboa.

The first part of the thesis details the oriented research focused on the identification of new shape memory alloy systems, on the transfer of properties at micro and nanoscale and the development of investigation tools for cost-efficient exploration of new functional and multifunctional alloy systems in compositional spreads. Co-Ni-Ga is the main system discussed, based on experimental observations, belonging to the ferromagnetic shape memory alloys group.

The second part highlights the original contribution to the structural control of shape memory alloys within the micro and nanocrystalline range and the resulting influence on particular functionalities, by means of severe plastic deformation, rapid solidification of bulk or ribbons and films deposited by sputtering and laser ablation, respectively microengineered transitions in shape memory alloys films are the subject of the third part focused on the ways to control the phase transformations that develops under thermoelastic constraints, in order to tune the actuation of bimorph and trimorph-type actuators.

The challenges in shape memory alloy welding have been addressed by identifying methods that could lead to



minimal changes in the composition, microstructure and functionality, as well as on the interaction between laser beam and new shape memory alloys belonging to the ferromagnetic group.

The plan for advancement and career development is based on the proven skills to conduct and coordinate high-level research and teaching activities at academic level and to initiate successful international collaborations in the field of advanced materials. The plan is structured on several interrelated activities - design, fabrication, implementation, education and training in the field of advanced materials - that fully complement each other in the same directions, and aims to:

The full abstract at: <http://www.cnatdcu.ro/wp-content/uploads/2012/06/Rezumatul-Tezei-de-abilitare.pdf>

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**Abstract:** In a society characterized by frequent changes, software must evolve at the same pace. To be able to evolve and adapt to new requirements, software has to be prepared for changes, which in return require high design and implementation quality. This habilitation thesis is the summary of the research that we performed during the last ten years on the assessment and improvement of design quality in object-oriented systems. This research direction has grown significantly over the last years due to the exponential increase of large-scale object-oriented systems. In such systems integration or bug fixing become so unpredictable that it becomes more cost-effective to rewrite the system.

However, the cause of such situations is less visible: the internal quality of the system's design is declining; and duplicated code, overly complex methods or non-cohesive classes are just a few signs of this decline. These, and many others, are usually the symptoms of higher-level design problems, which are usually known as design flaws. In software engineering, measurement is essential, as otherwise we risk losing control due to excessive complexity. Consequently, software metrics are the foundation of our research.

Thus, we start the thesis by describing our approach to defining metrics in a way that is both accurate and easy to understand, and to establish-ing meaning full metrics thresholds. In the context of metrics we also introduce the Overview Pyramid, an integrated, metrics-based visualization aimed to characterize the complexity, coupling and inheritance usage in object-oriented system.

While metrics are needed for the assessment of software design, we argue that isolated metrics cannot serve this goal in a way that leads to improvement actions. Going from abnormal numbers to the recognition of design flaws is impossible because the interpretation of individual metrics is too fine grained to indicate real design flaws.



The full abstract at:

<http://www.cnatdcu.ro/wp-content/uploads/2012/06/Teza-de-abilitare3.pdf>

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**Abstract:** The research activity and achievements presented here are developed in two main thematic directions. The first one is “Thin-walled cold-formed steel members”, which continues and diversify with new subjects, the topic of the PhD Thesis. It should be noted that the activity of the candidate in the field of thin-walled cold-formed steel structures (18 years of research in this field), from the beginning, from November 1994, until the defending of PhD Thesis, and for the post-thesis period, is in line with the fields of research of Steel Structures Research School of Timișoara. It may be underlined the long tradition of the Timișoara School in the field of thin-walled cold-formed steel structures – more than 40 years of activity. The new subjects of research in the post-thesis period can be divided in two big classes, each of them related to the following aspects:

**Theoretical contributions:**

- Post-elastic strength of thin-walled cold-formed steel members. Plastic mechanisms for members in compression and bending;
- Behavior of multi-span cold-formed Z-purlins with bolted lapped connections;
- Ultimate design capacity of pitch-roof portal frames made by thin-walled cold-formed steel members;
- Behavior of cold-formed steel perforated pallet rack sections in compression.

**Innovative structural systems:**

- Wall Stud Modular System (WSMS) – Bungalow type buildings used as shops, offices, for industrial purposes, for housing or school facilities;
- Hall Type Framed Structure (HTFS) – are

used as small and medium size single storey industrial buildings and storehouses;

- Penthouse Framed Structure (PFS) – for refurbishment and restructuring by vertical addition of new storey the existing buildings;
- Affordable Houses (AH).

For these innovative structural systems both technical and environmental performances have been studied.

The main achievements and results are presented in detail in Chapter (b-i): Scientific, professional and academic achievements.



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**Abstract:** Since the PhD thesis elaborated in 1997 the professional activities in the field of research and education had the topics related to thermal engineering. Until 2002 the topics were mostly in the field of compact heat exchangers and numerical modeling of thermal phenomena. In 2002 research activities were performed at the University Of Tokyo Institute Of Industrial Science through the project made in Prof. Shigefumi Nishio laboratory with the following title: Study of Micro-channel Heat Sinks for LSI Chip Cooling. Considering, at that time the available results about experimental research on micro-channel heat transfer and fluid flow characteristics, one can conclude that there were a large scattering in the obtained results. This was especially serious in the case of the heat transfer results. For example, there is an optimum size of channels in the so-called micro-channel heat sink and the result of optimization depends strongly on the heat transfer characteristics in micro-channels. So, this was the reason for making the experimental research on single-phase micro tube heat transfer. The research report was published in the International Journal of Heat and Mass Transfer [24] that was cited 93 times since 2005. After that, the research activities in the field of micro-channel heat transfer and fluid flow were further developed at the *Politehnica* University of Timisoara and Laboratory for numerical simulations in thermal engineering. The issues that were considered were related to influence of fluid properties, wall axial conduction, partial heating and viscous heating on heat transfer and fluid flow behavior in micro-channels. It has to be state that for these phenomena the proper numerical

codes were developed based on finite volume method considering microtubes and micro-channel heat sinks.

Moreover, in order to optimize the micro scale thermal devices the various flow configurations were considered. The new concept of micro-channel heat sink with tangential impingement jet at the inlet cross section was proposed.



The full abstract at:

[http://www.cnatdcu.ro/wp-content/uploads/2012/06/teza\\_abilitare\\_Lelea.pdf](http://www.cnatdcu.ro/wp-content/uploads/2012/06/teza_abilitare_Lelea.pdf)

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