# EFFECTIVE TECHNIQUES TO ENHANCE IMAGES AND VIDEOS

Author: Cosmin ANCUȚI

## Abstract

In this habilitation thesis are presented my research activity and the main academic results obtained after obtaining my PhD, from the second half of 2009 to date. In the following are described the main directions of my research in image processing and computer vision fields: color-to-grayscale conversion, image dehazing, fusion-based enhancing techniques, preprocessing techniques for computer vision applications and enhancing underwater images.

Color-to-grayscale conversion refers to mapping three dimensional color information onto a single dimension while still preserving the original appearance, contrast and finest details. We present the main contributions of our effective decolorization algorithm that preserves the appearance of the original color image. Image dehazing refers to the process of enhancing the visibility in images degraded by haze. In outdoor environments, light reflected from object surfaces is commonly scattered due to the impurities of the aerosol, or the presence of atmospheric phenomena such as fog and haze yielding images characterized by poor contrast, lower saturation and additional noise. In our work we developed an alternative approach to solving this challenging problem. Our technique is based on the remark that the distance from the observer to the scene objects is highly correlated with the contrast degradation and the fading of the object colors.

Image dehazing refers to the process of enhancing the visibility in images degraded by haze. In outdoor environments, light reflected from object surfaces is commonly scattered due to the impurities of the aerosol, or the presence of atmospheric phenomena such as fog and haze yielding images characterized by poor contrast, lower saturation and additional noise. In our work we developed an alternative approach to solving this challenging problem. Our technique is based on the remark that the distance from the observer to the scene objects is highly correlated with the contrast degradation and the fading of the object colors.

Preprocessing techniques for computer vision applications. Firstly, in our previous work we introduced a decolorization technique that is suitable to match images based on local feature points


Enhancing Underwater Images. We describe a technique published in our work that is able to enhance underwater images. It aims to yield a final image that overcomes the deficiencies existing in the degraded input images by employing several weight maps that discriminate the regions characterized by poor visibility.

The full abstract at:
http://www.upt.ro/img/files/2013-2014/ doctorat/ abilitare/ Ancuti/Rezumat_abiltare_Cosmin%20Ancuti_lb_eng.pdf

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# CONTRIBUTIONS TO THE BEHAVIOUR OF COMPOSITE ELEMENTS FOR BUILDINGS PLACED IN SEISMIC AREAS AND HIGH QUALITY CONSTRUCTION WORKS THROUGH MONITORING

Author: Daniel DAN

## Abstract

The present thesis summarizes the research of activity, after the PhD thesis was defended at the Politehnica University of Timisoara 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.
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.
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.

The full abstract at:
http://www.upt.ro/administrare/dgac1/file/2013-2014/abilitare/Dan_Daniel/Abstract_Habilitation%20Thesis_Daniel_DAN_EN.pdf

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# CONTRIBUTIONS TO THE BEHAVIOR OF STRUCTURES UNDER EXTREME LOADING

Author: Florea DINU

## Abstract

The Habilitation Thesis presents the past activity of the candidate after defending the PhD Thesis at The Politehnica University Timişoara and also plans of future research and personal developments. The PhD Thesis, entitled "Behaviour of MR steel frames with semirigid joints" was prepared under the coordination of Acad. Dan Mateescu. The doctoral degree was confirmed by The Ministry of Education and Research, Order no. 1300/112/C, from 23.12.2004.

Within the period 2004-2014, most of activity concentrated on extending the research topics developed during the PhD period. Starting from the seismic behavior of steel framed buildings, performance based seismic design methodology and the factors that affect one of the key properties, i.e. ductility of members and connections, the research activity extended to other extreme actions, with the aim of providing a complete set of design requirements under any type of extreme loading. These new topics partially continued the previous activity, but there were also new topics that emerged from the previous activity. As a direct consequence of the research activity, efforts have been paid to bring these new concepts into real applications. Thus, there were several projects that may be viewed as innovative, from the point of view of the structural system, connections, detailing and use of materials or analysis techniques. For their innovative character, some applications have been awarded by prestigious national and international organizations.

A great support for the activity that followed after the PhD, may be attributed to the participation of the candidate to national and international projects and also to the cooperation with industrial partners. This can be justified by the publication of more than 40 papers, mostly in international conferences and journals. The main achievements and results are presented in detail in the Thesis.

In what concerns the future activities and development plans, the following research topics will be further developed or started:

- Guidelines for the collapse control performance based design of multi-story frame buildings against accidental actions


- Improved structural systems and application to buildings
- New structural systems based on removable dissipative members
- New hysteretic devices with improved damping characteristics
- Application of new braced systems to design of new buildings or for refurbishing existing buildings.
- Durability of structures under climate change effects
- Evaluation of the reliability and durability of structures along the designed lifetime
- Methodologies for Performance Based Evaluation / Design of construction for progressive climate action exposures;
- Intervention strategies and adaptive building technologies

The full abstract at:
http://www.upt.ro/img/files/2013-2014/ doctorat/abilitare/Dinu/Rezumat_teza_eng_Dinu.pdf

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# NEW ANALYTICAL APPROACHES TO NONLINEAR VIBRATIONS

Author: Nicolae Horaţius HERIŞANU

## Abstract

This habilitation thesis briefly presents the achievements of the authors in the scientific research developed after defending his PhD thesis within "Politehnica" University of Timisoara. These results are presented in 25 journal papers published in prestigious journals indexed by Science Citation Index, having significant impact factors, a monograph published by Springer Verlag – Berlin and other conference papers presented at national and international conferences as well as other journal papers.
The thesis is structured on 6 Chapters; the first 5 Chapters present the achievements of the authors in the last years and the last Chapter presents some evolution and development plans.
The main research direction on which this thesis is built-up is based on the study of nonlinear vibration using original analytical methods, which have been published in the literature by the author and his collaborators in the last decade.
After a brief introductory Chapter, the next 4 Chapters are intended to present the 4 original analytical methods proposed by the author in the literature: the Optimal Homotopy Asymptotic Method (OHAM), the Optimal Variational Iteration Method (OVIM), the Optimal Homotopy Perturbation Method (OHPM) and the Optimal Iteration Perturbation Method (OIPM).
All these original methods published in the literature by the author of the thesis and his collaborator Vasile Marinca after a close and fruitful collaboration, have a common idea, allowing obtaining solutions to problems related to nonlinear dynamical systems from mechanical engineering in an optimal approach. The analytical solutions depend on several initially unknown parameters, called "convergence-control parameters" whose optimal values are determined through a rigorous algorithm intended to minimize the residual obtained after replacing the analytical solution in the initial equation, so that the solutions converge to the exact ones with a remarkable rapidity.


The key of the problem which ensure the success of these methods consist in the determination of the optimal values of convergence-control parameters, which task can be accomplished in various ways, using some approaches such as the least square method, the collocation method, the Galerkin method, and so on, which are implemented using a computer and specific programs.
Finally, the last Chapter of the thesis is intended to identify some opportunities concerning possible development of researches and a continuation of increasing the performances of the proposed methods so that these methods would became mature ones, applicable with less computational efforts and largely accessible for anyone. There is identified significant opportunities to obtain new results by enlarging the research team which will involve future PhD students which will be enrolled.

The full abstract at:
http://www.upt.ro/img/files/2014-2015/doctorat/abilitare/herisanu/Abstract.pdf

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# INTELLIGENT MONITORING SYSTEMS ACHIEVEMENT APPLIED IN POWER SYSTEMS

Author: Doru VĂTĂU

## Abstract

IIn the frame of the habilitation thesis are prezented the most important personal achievements on scientific, professional and academical plan that I´ve obtained in the period of time January 1997 – June 2014. This period follows to my public presentation of the PhD thesis that took place on January 17th, 1997 (later confirmed by the Order of the Ministry of Education No. 3991 from June 2nd, 1997).

The habilitation thesis is structured in three parts: the abstract, the technical presentation and the bibliographic references.

The habilitation thesis starts with an abstract that includes the synthesis of the habilitation thesis. The second part of the thesis, named „Technical Presentation" includes five sections. In the first section are presented briefly the remarkable achievements obtained through research and educational activities (list with publications and grants classified on three research directions, new disciplines introduced in the education plans, taught courses, contributions brought to the development of the syllabus, invited professor, practice activities with students, conducting license and dissertation theses, endowed laboratories and library, international cooperation, management activities, etc.). The second section presents the contributions adequate to the first research direction

"Systems for monitoring and analysis of the technical status of the materials, electrical machines and electrical equipment used in power systems". The third section makes reference to the contributions obtained in the second research direction „ Power quality monitoring equipment designed for the connection points between

the transmission and distribution network". The fourth section presents the contributions from the third research direction „Power generation, transmission and delivery environment impact monitoring systems".

The last section presents the evolution and development plan regarding the professional, scientific and academic career, as well as exact methods of putting them into practice.

The conceived action plan includes three directions of research/ teaching / practical applications that are: renewable energy sources; materials, equipments, methods and work techniques under high voltage; the impact of electrical installations on the environment.

The full abstract at:
hhttp://www.upt.ro/img/files/2014-2015/doctorat/abilitare/vatau/Teza_abilitare1_en_Vatau_Doru.pdf

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# FIRE DESIGN OF CIVIL ENGINEERING STRUCTURES

Author: Raul Dan ZAHARIA

## Abstract

The thesis summarizes a part of the research activity of the candidate after defending the PhD Thesis at the Politehnica University of Timisoara in February 2000. The selected activity was considered to be relevant in terms of originality and importance, in order to anticipate an independent development of the further research and teaching career. The presentation of the post-doctoral activity is developed within the main thematic direction: "Fire design of civil engineering structures". A secondary direction is also considered: "Design assisted by testing".

The candidate was involved in the main topic "Fire design of civil engineering structures" since 2000, after the defense of the PhD thesis, when he obtained a research grant of one year, offered by the Services for Scientific and Cultural Affairs of the prime Minister of Belgium. The research was lead by Prof. Jean Marc Franssen from Liege University in Belgium, a world-wide recognized pioneer in the field of the fire design of civil engineering structures, with decisive contributions in the relatively recent topic of calculation of the fire resistance of structures. The research was focused on the fire behaviour of high-rise steel rack structures and a description of the main results of the research is presented in Part B section 2.5.1 "Fire resistance analysis of high-rise rack structures".

The relevance of the scientific activity and the recognition of the national and international activity in the field of the first main direction "Fire design of civil engineering structures" is emphasized by the publications of the candidate, mostly in cooperation with European researchers, but also by the involvement in two European technical committees. Another relevant aspect for the recognition of the international activity of the candidate in the field is that he was member of the Scientific Committees for the recent editions of the only two specialised international conferences dedicated exclusively to the structural analysis component of the fire engineering.

The implementation of the fire design principles is still an on-going process in Romania.

However, in the last decade, the candidate calculated the fire resistance of the structural elements for some structures built in Romania. This was a premiere in Romania and, up to this moment, no other similar design cases exist.

The ful abstract at:
http://www.upt.ro/administrare/dgac1/file/2013-2014/abilitare/Raul_Zaharia/Abstract-Raul_ZAHARIA_en.pdf

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# MONETARY POLICY, FINANCIAL STABILITY AND ASSET PRICES

Author: Claudiu Tiberiu ALBULESCU

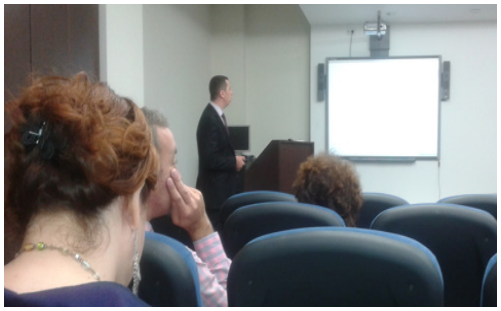
## Abstract

The present habilitation thesis includes two main sections, namely the part covering the scientific contributions and the career development plan. The first section highlights the candidate's contributions in the field of monetary policy, financial stability and asset prices since the completion of the PhD program up to present, while the second part covers the candidate's projects for his academic activity, including future research directions.

The first part of the thesis summarizes our main scientific contributions in the field of monetary policy, financial stability and asset prices, in the context of the European economic and financial integration. Our scientific contributions are grouped considering three related directions: the link between the monetary policy and the systemic financial stability, the exchange rate stability and the relationship between the integration process, the stability and the financial volatility.

In the field of monetary policy and financial stability, the main contributions is represented by the construction of an aggregate financial instability index Albulescu (2010) and the way in which the European Central Bank considered the financial instability in its monetary policy decisions (Albulescu, 2012; Albulescu, 2013; Albulescu et al., 2013), in an augmented Taylor rule framework.

In the field of the exchange rate stability, we report two main contributions. The first is focused on the assessment of the equilibrium exchange rate determinants for the Central and Eastern European countries (Albulescu and Goyeau, 2011a). To this end, we use a panel data analysis and a behavioral model and discover that, for the analyzed period, in Latvia and Romania, the nominal exchange rate seems to be undervalued in comparison with the equilibrium exchange rate. The second contribution in this area is the assessment of the impact of movements in international oil prices, on the real exchange equilibrium rate in Romania, using a wavelet framework. We identify several periods of influence, at different frequencies, between the oil price and the exchange rate. Moreover, we prove that positive shocks have a more powerful impact on the exchange rate movements in the short run.



Finally, in the field of integration, financial stability and financial volatility, we show on the one hand that the financial stability plays an important role in promoting the economic and financial integration and the foreign direct investments inflows (Albulescu et al., 2010; Albulescu, 2011). Regarding the bidirectional causality between the equity index derivatives and the volatility of their underlying assets, Albulescu and Goyeau (2011b) use a vector auto-regression model and Granger causality tests and show that there is no clear evidence regarding this bidirectional causality, while Albulescu and Tiwari (2013) document several asymmetric bidirectional relationships.

The full abstract at:
http://www.uvt.ro/en/educatie/studii-universitare-de-doctorat/ordine-privind-acordarea-titlului-de-doctor/abilitare-albulescu/

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