Non-Destructive Testing Laboratory
“God saw all that he had made, and it was very good.”

Holy Bible

Genesis 1:31
Team

**Permanent staff:**
- 4 Senior researchers
  - 3 Ph.D.
  - 1 CS I - Head of Laboratory
  - 1 CS II – Deputy Head
  - 2 CS

**Auxiliary staff**
- 1 Engineer

**Graduated students**
- 2 Technicians
Research directions
Development of the theoretical basis for nondestructive examination of new and advanced materials

- Development of new types of metamaterials and metamaterials lenses for electromagnetic field focusing and handling of evanescent waves

- Development of new analytical and numerical methods for extraction of constitutive parameters of metamaterials by inversion as well as for the characterization of the lenses with metamaterials based on Fourier optics
Development of the theoretical basis for nondestructive examination of new and advanced materials

- Development of new linearization methods and data inversion applicable to the evaluation of hydrogen content and hydrides in metallic alloys used in nuclear energy, in techniques of nonlinear eddy current.
- Development of new procedures for evaluation of elastic matrix of new and advanced materials using guided ultrasonic waves and resonant ultrasound spectroscopy.
Development of the theoretical basis for nondestructive examination of new and advanced materials

- Development of analytical and numerical methods for determination of energy levels of quantum dots, of electrical and thermal conductivity of nanocomposites with carbon nanotubes
- Development of new methods for data fusion in order to increase the probability of detection for a required reliability coefficient.

Main results
- 7 ISI articles
- 57 other publications.
Development of new experimental techniques for nondestructive evaluation of new and advanced materials

- Development of new methods for electromagnetic imaging of metallic strip gratings, metallic fillers embedded in plastic, composites reinforced with carbon fibers and nanocomposites with carbon nanotubes, using evanescent waves and lenses with metamaterials.
Development of new experimental techniques for nondestructive evaluation of new and advanced materials
Development of new experimental techniques for nondestructive evaluation of new and advanced materials

- Development of new electromagnetic methods for noninvasive evaluation of heart valves prostheses Bjork Shiley convexo-concave type
Development of new experimental techniques for nondestructive evaluation of new and advanced materials

- Development of new electromagnetic methods for noninvasive evaluation of heart valves prostheses Bjork Shiley convexo-concave type
Development of new experimental techniques for nondestructive evaluation of new and advanced materials

- Development of new electromagnetic methods for evaluation of components from nuclear power plants PHWR type
Development of new experimental techniques for nondestructive evaluation of new and advanced materials

- Development of noninvasive evaluation techniques for hip prostheses by resonant ultrasound spectroscopy using transducers with Hertzian contact
Development of new experimental techniques for nondestructive evaluation of new and advanced materials

• Development of techniques for evaluation of delaminations in composite materials using ultrasound phased array transducers, noncontact ultrasound transducers and transducers with Hertzian contact.
Development of new experimental techniques for nondestructive evaluation of new and advanced materials

- Development of methods for determination of elasticity matrix of materials and structures from composite materials including natural composites.
Development of new experimental techniques for nondestructive evaluation of new and advanced materials

- Development of methods and electromagnetic techniques for detection and evaluation of buried objects based on ground penetrating radar and electromagnetic induction sensors array

Main results:
- 11 ISI articles
- 78 other publications
Development of new electromagnetic transducers with metamaterials, patent no. RO126245-A0/2011, awarded with Gold Medal and First Prize of AROTT at Inventika 2011 Bucharest
Development of new types of sensors, transducers, equipment, informatics methods for characterization and evaluation of the lifetime of certain pieces and structures.

Development of a new type of electromagnetic sensors arrays for evaluation of soil conditions and detection of buried objects patent no. RO125738-A0/2010, awarded with Bronze medal at 38th Salon of Inventions Genève, 2010 and Gold medal at Inventika Bucharest 2010.
Design and realization of complex equipment for examination of tubes from heat exchangers, patent no. RO125632-A2/2010

Development of new types of sensors, transducers, equipment, informatics methods for characterization and evaluation of the lifetime of certain pieces and structures.
Development of new types of sensors, transducers, equipment, informatics methods for characterization and evaluation of the lifetime of certain pieces and structures

Elaboration of numerical codes for prediction of the lifetime based on Markov hidden chains
Development of new types of sensors, transducers, equipment, informatics methods for characterization and evaluation of the lifetime of certain pieces and structures.

Elaboration of numerical codes for automatic analysis of data provided by eddy current control equipment:

- using Newman Person detection and feature extraction
- using data mining
Development of new types of sensors, transducers, equipment, informatics methods for characterization and evaluation of the lifetime of certain pieces and structures

Development of expert systems
Development of new types of sensors, transducers, equipment, informatics methods for characterization and evaluation of the lifetime of certain pieces and structures

Development of new algorithms and numerical codes for processing and post processing of signals and images specifics to nondestructive examination

Main results
8 ISI articles
over 50 other publications
The laboratory has the endowment of high degree of novelty and personnel well specialized so that it is able to open and approach new directions in the broad area on nondestructive examination of materials, at the frontier between technical physics, mechanical engineering, electronics, informatics, etc.

The laboratory has functional international collaboration with producer of composite materials (CETEX- The Netherlands), of medical prostheses (Pfizer USA, HTI Technologies France), materials for nuclear power plants (CNEA Argentina, AECL Canada).
International collaborations

• Newcastle University, UK, School of Electrical, Electronic and Computing Engineering, Laboratory of Sensing Technology – Prof. G.Y.Tian
• Birmingham University, UK, School of Physics and Astronomy, Nanoscale Physics laboratory, Prof.R.Palmer
• Imperial College, UK, Laboratory of Nondestructive Evaluation, Prof. P. Cawley
• Imperial College, UK, Metamaterials Laboratory, Sir. J. Pendry
International collaborations

- Michigan State University USA, College of Engineering, Department of Electrical and Computing Engineering, Prof. L. Udpa, Prof. S. S. Udpa
- University of Ljubljana, Slovenia, Faculty of Mechanical Engineering, Prof. J. Grum
- University of Zilina, Slovak Republic, Faculty of Electrical Engineering, Assoc. Prof. D. Faktorova
- Comisión Nacional de Energía Atómica, Centro Atómico Constituyentes, Buenos Aires, Argentina, ENDE, Dr. M. Ruch
International collaborations

- Federal University of Rio of Janeiro, Brazil, Department of Metallurgical and Materials, Laboratory of Nondestructive Testing, Corrosion and Welding, Engineering, Prof. J. Rebello
- University of Minho, Guimarães, Portugal, School of Engineering, Prof. F. Silva
- University of West Macedonia, Greece, Department of Mechanical Engineering, NDT Laboratory, Assoc. Prof. T. Theodoulidis
National collaborations

- **University Al.I Cuza Iasi**, Faculty of Physics, Prof.Al.Stancu
- **Technical University Gh.Asachi Iasi**: Faculty of Mechanical Engineering, Prof.P.Barsanescu; Faculty of Materials Science and Engineering, Prof.P.Vizureanu, Faculty of Civil Engineering, Prof.C.Comisu
- ; Faculty of Hydrotechnics, Geodesy and Environmental Engineering, Prog.I.Giurma
- **Transilvania University Brasov**, Faculty of Mechanical Engineering and Faculty of Wood Industry, Prof.I.Curtu
- **Politehnica University Bucharest**, The Faculty of Mechanics and Mechatronics, Faculty of Electrical and Electronic Engineering, Prof.D.Ioan
National collaborations

- **University Ovidius, Constanta**, Faculty of Mechanical Engineering, Prof. E. Mamut
- **National R & D Institute for Welding and Material Testing ISIM Timişoara**, Director stiintific Dr. N. Farbas
- **SC IPA SA** - Research Development, Engineering and Manufacturing for Automation Equipment and Systems, Bucharest and Craiova, Ing. F. Udrescu
- **SC NDT Nuclear Research and Services Bucuresti** Dr. M. Soare
The NDT Laboratory has a good national and international visibility as its personnel

- has sustained invited lessons at University of Ljubljana, Slovenia, Faculty of Mechanical Engineering; University of Zilina, Slovak Republik; Faculty of Electrical Engineering, keynote lecture at 10th International Conference: Application of Contemporary Non-Destructive Testing in Engineering, 01–03 September, 2009, Ljubljana, Slovenia;
- are in Standing Committee and Scientific Committee of Workshop NDT in Progress Prague, International Workshop on Electromagnetic Nondestructive Evaluation (ENDE), European Conference on Nondestructive Testing (ECNDT)
- were chairperson of sections at over 10 international scientific manifestations

The Head of Laboratory, Professor R. Grimberg has received Distinguished Visiting Fellowship Award, by Royal Academy of Engineering UK.
International Projects

• Nondestructive evaluation by electromagnetic procedures and elastic waves of the carbon epoxy composites, data fusion and reparation qualification - 371/2010, Bilateral cooperation with University of Ljubljana, **Slovenia**, 5.000 €, 2010-2011

• Metamaterials for high frequency electromagnetic nondestructive evaluation –Bilateral cooperation with University of Zilina, **Slovak Republic**, 5.000 €, 2011-2012

• New Methods for Computing Electromagnetic Fields Generated by Transducers of Arbitrary Shapes - #0303914 – National Science Foundation – **USA**, 47.000 USD, 2003-2007

• Eddy current methods for quantitative nondestructive evaluation of pressure tubes from PHWR nuclear power plants – CRP I3.30.10 – **IAEA** Vienna, 21.000 USD, 2000-2009
<table>
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<th>Project title</th>
<th>Call name</th>
<th>Name of contracting authority</th>
<th>Total budget (thousands of euros)</th>
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<tr>
<td>Phenomena and physical processes in 1D and 2D metamaterials with applications in radiofrequency, development of sensors and noninvasive techniques</td>
<td>PN 09 43-01 04</td>
<td>National Authority for Scientific Research</td>
<td>150,000€</td>
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<td>Development of new concepts, techniques and skills based on synergic methods for noninvasive evaluation of novel and advanced materials, micro and nanostructured materials; lifetime estimation of structures made with these materials - SINERMAT</td>
<td>CEEX Contract 6110/2005</td>
<td>The Bucharest Academy of Economic Studies</td>
<td>370,000 €</td>
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<td>Automated nondestructive examination concept for heat exchanger tubes using the eddy current method with a sensor made from nanostructured material EDDY</td>
<td>CEEX Contract 70/2006;</td>
<td>National Institute of Research and Development for Welding and Material Testing - ISIM Timisoara</td>
<td>106,000 €</td>
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<td>Expert systems for thermal systems command PROTHERM</td>
<td>CEEX Contract 171/2005;</td>
<td>Technical University Gh.Asachi Iasi</td>
<td>46,500 €</td>
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<td>Management system by noninvasive methods for mechanical-physic features, for fiability and weathering of composite materials, embedded technologies for monitoring in operation; applications of lingo-cellulose composites, of light structures in composite materials , of nanostructured composites – RO-LIGHT</td>
<td>CEEX Contract 49/2006</td>
<td>Politehnica University of Bucharest - Program MATNANTECH</td>
<td>350,426 €</td>
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<td>Noninvasive electromagnetic method for behavior and integrity evaluation of biocompatible complex structures austenitic steel-nanostructured carbon-application to BSICC implanted mechanical heart valve</td>
<td>Grant COD CNCSIS 586 Contract nr. 59GR/2006</td>
<td>National Research Council for Higher Education (CNCSIS)</td>
<td>53,750 €</td>
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<td>Mapping of the electrical conductivity and/or magnetic susceptibility using electromagnetic sensors array; applications to remote determination of soil structure and breaks in levees</td>
<td>Grant COD CNCSIS 706 Contract nr. 59GR/2006</td>
<td>National Research Council for Higher Education (CNCSIS)</td>
<td>48,214 €</td>
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<td>Monitoring, diagnosis and repairing of complex structures from advanced materials MODIS</td>
<td>PN II - Partership Contract: 71-016/2007</td>
<td>The National Centre for Programme Management (CNMP)</td>
<td>249,822 €</td>
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<td>Detection systems based on electromagnetic sensors array for soil characterization and buried object recognition SYSARR</td>
<td>PN II - Partership Contract: 32-134/01.10.2008</td>
<td>Executive Unit for Financing Higher Education, Research, Development and Innovation UEFISCDI</td>
<td>231,867 €</td>
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<tr>
<td>Grimberg R., Electromagnetic nondestructive evaluation: present and future, STROJNISKI VESTNIK-JOURNAL OF MECHANICAL ENGINEERING, Volume 57, Issue 3, Pages 204-217, MAR 2011</td>
<td>0.21851</td>
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<td>Iftimie N., Luca D., Iacomi F., Girtan M., Mardare D., Gas sensing materials based on TiO(2) thin films, JOURNAL OF VACUUM SCIENCE &amp; TECHNOLOGY B, Volume 27, Issue 1, Pages 534-541, JAN-FEB 2009</td>
<td>1.08313</td>
<td>3</td>
<td></td>
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<tr>
<td>Iftimie N., Iacomi F., Rodasca N., High performance gas sensing materials based on nanodotstructured zinc oxide films, JOURNAL OF OPTOELECTRONICS AND ADVANCED MATERIALS, Volume 10, Issue 7, Pages 1810-1813, JUL 2008</td>
<td>0.32990</td>
<td>0</td>
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<tr>
<td>Grimberg R., Udpa L., Savin A., Steigmann R., Vizureanu F., Bruma A., Udpa S.S., Remote field eddy current control using rotating magnetic field transducer: Application to pressure tubes examination, RESEARCH IN NONDESTRUCTIVE EVALUATION, Volume 19, Issue 4, Pages 202-218, 2008</td>
<td>0.66543</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Grimberg R., Udpa L., Udpa S.S., Electromagnetic transducer for the determination of soil condition, INTERNATIONAL JOURNAL OF APPLIED ELECTROMAGNETICS AND MECHANICS, Volume 28, Issue 1-2, Pages 201-210, 2008</td>
<td>0.26492</td>
<td>1</td>
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<td>Astefanesei I., Dumitru I., Grimberg R., Stancu A., The effect of a metallic layer on energetic states of quantum dots, SENSOR LETTERS, Volume 5, Issue 1, Pages 185-188, MAR 2007</td>
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<td><strong>22.56030</strong></td>
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Future works

- Structural health monitoring of wind turbine farms
- High resolution electromagnetic microsensors for noninvasive evaluation of advanced nano-composites
- Quasi-real time multisensor systems for detection, identification and evaluation of the risk factors in soil
“A creative man is motivated by the desire to achieve, not by the desire to beat other”

The Ayn Rand Letter
Vol. III, No. 24 August 26, 1974