NATIONAL INSTITUTE OF RESEARCH AND DEVELOPMENT IN MECHATRONICS AND MEASUREMENT TECHNIQUE
INCDMTM, BUCHAREST -ROMANIA

NANOSCIENCES AND NANOTECHNOLOGIES – MICRO/ NANOMECHATRONICS - PRESENT AND PERSPECTIVES

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INCDMTM Bucharest

- **INCDMTM as unique R&D centre in their field of mechatronics in Romania, is working mostly to achieve the main objectives of National Strategy and the European Research, watching convergence to the micro-nanotechnology, in re-appropriate activity, new equipments and high-tech mechatronic technology systems, intelligent measurement and control and transforming it into a flagship technology with high internal and international visibility.**

- **INCDMTM is member and coordinator of national or international research platforms, on a wide pallets of fields, similar to the European ones, develops research activities, marketing strategies and information dissemination processes**

Nanotechnologies for processing, characterization, measuring and calibration

- **Advanced technologies for nano-processing**

(1) Advanced technology and equipment for nano-processing with laser beam by the sintering method

- **Intelligent nano-technologies and nanometric control**

(1) Nanometric control and nano-technologies for the topography of surfaces – rugosity and contour
(2) Nanometric control and nano-technologies for the topography of surfaces– 3D topography
(3) Nanometric control and nano-technologies for the topography of surfaces – lengths
(4) Nanometric control and nano-technologies for the topography of surfaces – profiles
(5) Nanometric control and nano-technologies in industry – 3D
(6) Nano-technologies for nano-dimensional control in industry – interferometer
(7) Nano-technologies and nano-dimensional control for industry – heights
(8) Nano-technologies and nano-dimensional control for industry – linear and angular inspection

- **Advanced calibration nano-technologies**

(1) Advanced nano-technologies for the calibration of inductive comparators and transducers

- **Advanced calibration nano-technologies for characterizing nano-structures**

(1) Advanced technology for the evaluation of superficial structures

Advanced technology and equipment for nano-processing with laser beam by the sintering method

EOSINT M 270 TITAN VERSION equipment for nano-processing with laser beam uses the selective sintering in order to produce:

- models and prototypes for implantable bio-medical products, functional prototypes for the auto vehicle and for the airspace industry, high quality casts, as well as for designing and dynamically testing of implants and of other mechanical pieces used in the industry

- is used for creating complex geometries, impossible to carry out by other means of processing metal.

EOSINT M 270 TITAN VERSION

Nanometric control and nano-technologies for the topography of surfaces – rugosity and contour

Talysurf 120 Taylor Hobson

- The Form Talysurf series represents the international standard for rugosity, linearity and shape measuring
- Key characteristics include a highly-precise linear reference bar, a high resolution inductive transducer with a 1 nm track and a market-leading software

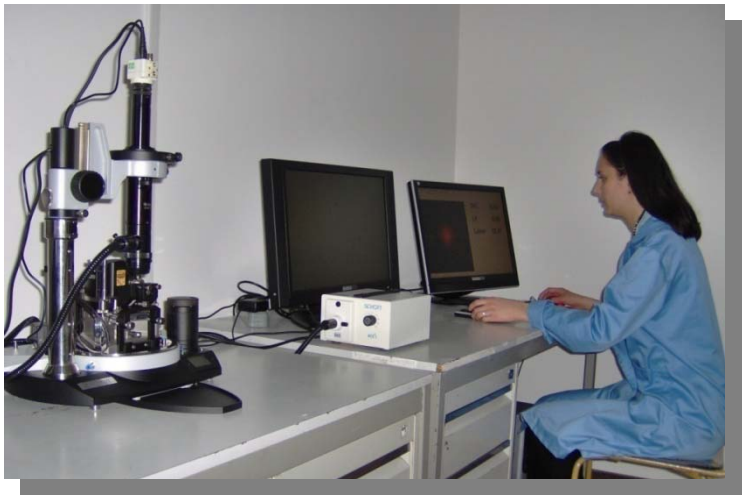
Aplications:

- rugosity checking and contour for axes, cog wheels in the processing industry, the airspace and the automobile industry.

Nanometric control and nano-technologies for the topography of surfaces– 3D topography

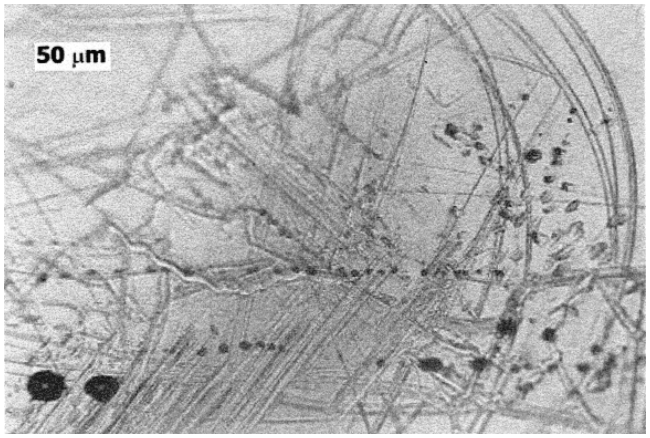
Atomic Force Microscope is used for a deep characterization of very thin film-like surfaces or for the surfaces of existing devices, with the aid of a measuring tip attached to the cantilever.

- 3D topography, spectroscopic analysis, elasticity determination for materials that form the surface, structural chemical analyses, microscope probes with magnetically modeling, nano-lithography, industry, etc.



Atomic force microscope

Corrosion sample



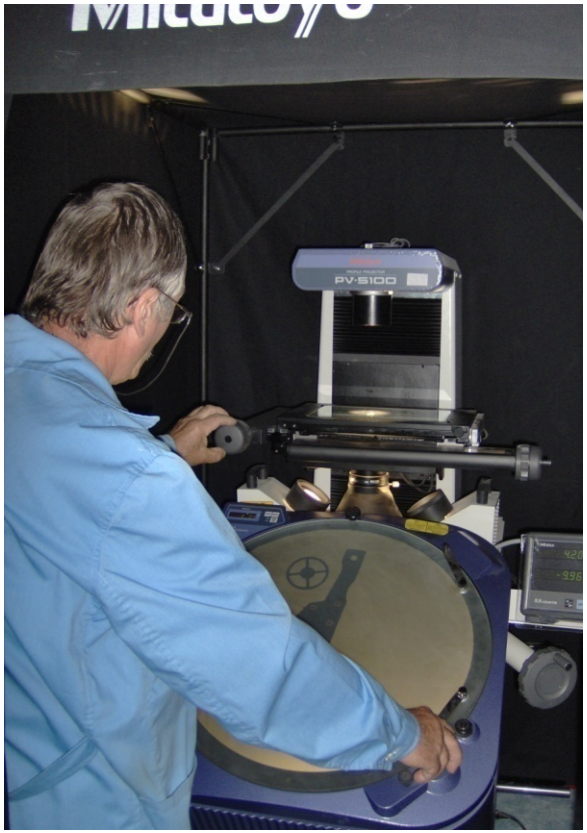
Nanometric control and nano-technologies for the topography of surfaces – lengths

DMS 680

- With the aid nano-techniques for measuring lengths that use the DMS 680 Joint Instruments device – Italy, the periodical checking of try gauge instruments and calibers is carried out.
- Is applied to the determining of the dimensional aberrations for cylindrical neat calibers, filleted calibers, metrological calibers

Nanometric control and nano-technologies the topography of surfaces – profiles

- Nano-technologies destined for checking nano-dimensional features of high precision marks uses high-tech equipments such as profile projectors.
- The PV-5100 (Mitutoyo) projector is a medium-sized device, with a 508 mm (diameter) display.
- The protection of the contour and the state of the surface of a work piece can be transmitted to a display with a 5x, 10x, 20x, 50x, 100x amplification factor and measuring and observation can also be performed.
- The determining of the dimensional and angular aberrations for gauges, calibers, plate caliber, fillets, etc., in the industrial and the metrological field



PV-5100 (Mitutoyo)

Nanometric control and nano-technologies of the topography of surfaces – 3D

Leitz Reference 600

- Checking nanotechniques for the 3D coordinates measuring machine Leitz Reference 600 – Germany ensures a high precision adequate for the inspection of standard geometries (cylindrical blocks, gear boxes) as well as for the measurement of any type of geometries such as cam shafts, screw compressors and many others.

Applications

- the determination of dimension aberrations for terminal measures, calibers, control devices, gauges.
- **t**he determination of shape aberrations and of position aberrations for gauges and ultra-precise control devices in the processing industry, mechatronics, air-space industry, automobile industry and metrology, etc.

Nano-technology for nano-dimensional control in industry

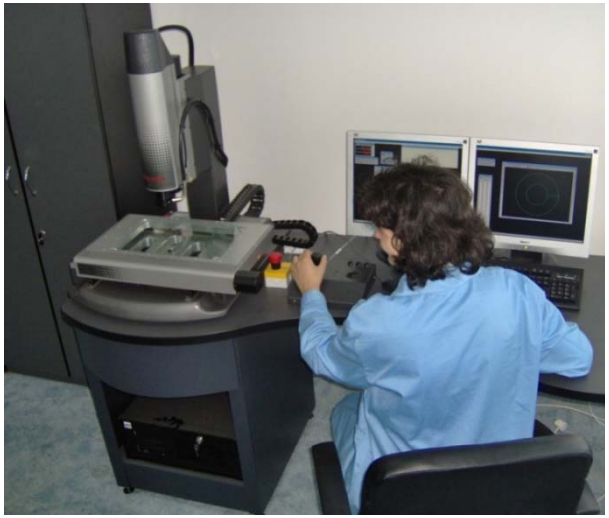
- The nano-technology of nano-measuring and of nano-calibration with the laser interferometer XL-80 leads to an increase in the functional precision of the mechatronic installations and equipments.
  - Measuring precision: ± 500 nm;
  - Frequency precision: ± 50 nm;

Aplication

- the calibration of measuring equipments: devices for coordinate measuring, devices for length measuring and direct measurements in the processing, airspace, mechatronic, automobile industry and metrology.

Laser interferometer XL- 80

Nano-technologies and nano-dimensional control in industry – liniar and angular inspection



Vision Sistem Starrett Galileo

- Nano-technologies for control of industrial marks uses the microscop with Vision Starrett Galileo System – USA which allows manual and automatic inspection of pieces, quickly, simple and accurate. The system uses two monitors and a measuring software similar to Windows operating system.

Aplications

- the determination of dimensional liniar and angular deviation for final measures, calibres and gauges
- the determination of paralelism and perpendicularity abberations, in the processing, mechatronic, air-space, electronic and electrotechnical indusrty as well as in metrology

Advanced nano-technologies for the nanometric calibration of intelligent instrumentation

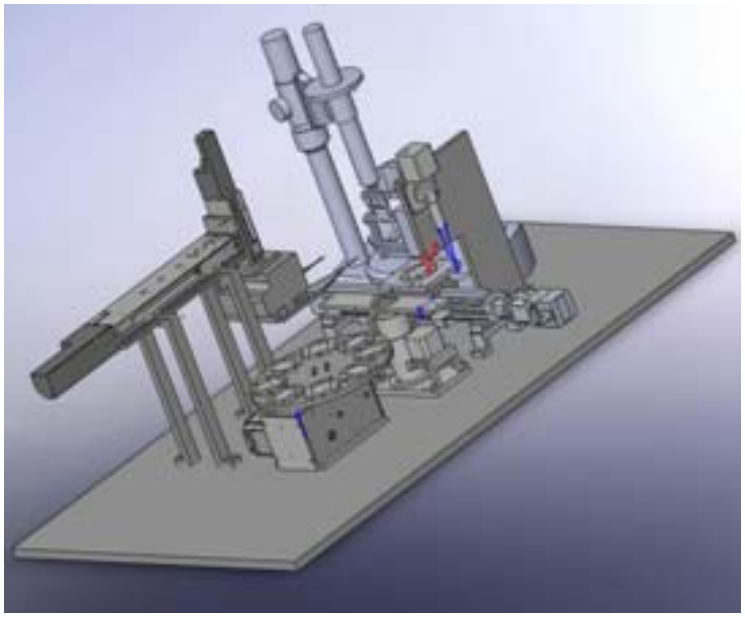
- OPTIMAR 100 Mahr is used for the calibration of comparators and inductive transducers. It is used within nano-calibration for beneficiaries in the high-tech industry.

Aplications

- digital and analogical comparators calibration
- in the processing, airspace, mechatronic and metrological industry

OPTIMAR 100 Mahr

Mechatronic system for nanometric calibration of nanotechnological equipments



- It was necessary to check the sensibility in nanotechnology domain
- It was combined mechatronics, precision measurements, optics, acquisition and processing data software in order to realize a calibration system with resolution in nanometric domain.

The calibration system has a controlled ultraprecise displacement and measurement laser system, optoelectronics system, AFM and robots for automatic transfer of nanotechnologic product from production flux to the calibration system and transfer of good products to the next phase of production flux

Research infrastructure

- **MEMS and NEMS Mechatronics Laboratory for characterization of surfaces topography using Atomic Force Microscopy**

- **“Rapid Prototyping” Laboratory for laser beam sinterization from superior composites**

- **Lenghts testing Laboratory**

Research Platforms

- **INCDMTM is member and coordinator of national or international research platforms, on a wide pallets of fields, similar to the European ones, develops research activities, marketing strategies and information dissemination processes.**

- **EUropean RObotics Platform EUROP – full member**
- **EUROP – Romanian Branch, Mr. Gheorghe Gheorghe – general manager of INCDMTM is the president of Miniaturized Robotics working group**
- **National Scientific Cluster for Mechatronics, Robotics and Sensorics "NANOMECATRONICA" – established by INCDMTM**
- **ROMNET-MINAFAB network - member**

European Robotics Technology Platform

- **INCDMTM is a full member** of EUROP
- EUROP is an industry-driven framework for the main stakeholders in robotics to strengthen Europe's competitiveness in robotic R&D, as well as global markets, and to improve quality of life
- EUROP has developed a joint European Strategic Research Agenda (SRA), which would help focus research initiatives and innovative activities towards maximum impact
- EUROP is one of several European Technology Platforms (ETPs) supported by the European Commission
- **EUROP Vision**
  - Develop a European robotics supply chain
  - Ensure public and personal security
  - Improve quality of life and expand scientific endeavours
- **Goals**
  - Promote European Robotics
  - Provide networking support for the European robotics community

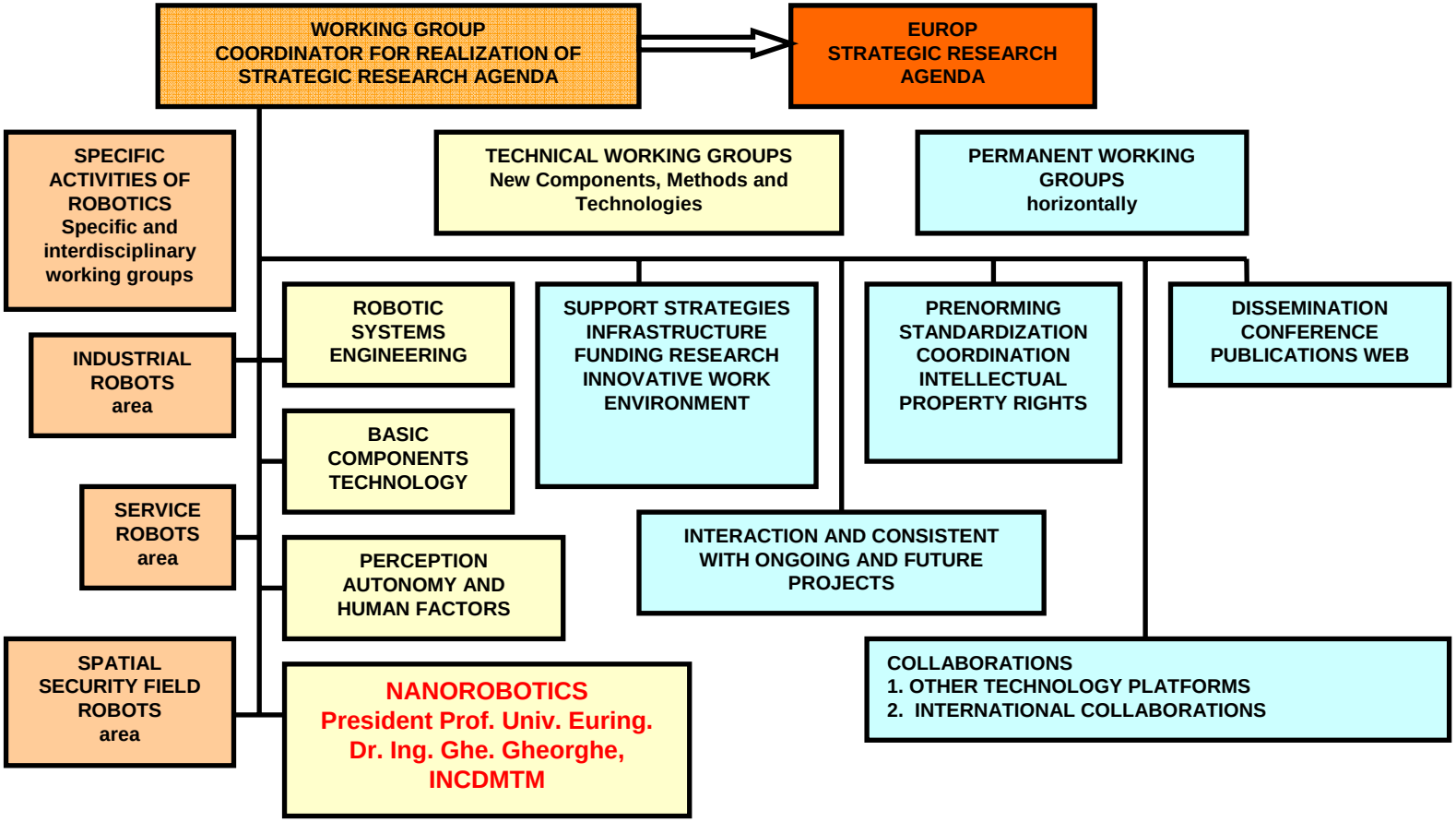
EUROP_RO EUropean RObotics Platform – Romanian Branch

Technical working groups

- Working Group Strategic Research Agenda
- Financial Working Group
- Infrastructure for Research Working Group
- Innovative Environment Working Group
- Know How, Technological Transfer and Specific Applications Working Group
- Technologies for Mechanical, Electromechanical, Mechatronics Components Technical Working Group
- Optical and Optoeletronics Components
- Industrial Robots-Robotized fabrication
- Perception, Autonomy and Human Factors Technical Working Group
- Electronic Systems for Robotics Technical Working Group
- Nanorobotics and Electropneumatical Components Technical Working Group – president Dr. Ing. Gheorghe Gheorghe
- Robotics for Medical Applications Technical Working Group
- Robotics for Recovery and Social Assistance Technical Working Group
- Information Technology Applications for Medical Robotics Working Group
- Robotics in Construction Technical Working Group
- Robotics in Security Technical Working Group
- Photonics Systems for Robotics

EUROP_RO EUropean RObotics Platform – Romanian Branch

Technical working groups



National Scientific Cluster for Mechatronics, Robotics and Sensorics "NANOMECATRONICA"

- **Ensures an advanced approach and scientifically development of the mentioned field, aligned to the performances and the competition set as standards by the European Union – the European Research Area and according to Lisbon Strategy**
- **Is responsible and national coordinator of advanced scientific research works on micro- / nanotechnologies for mechatronics, sensorics, robotics, mechatronic MEMS and NEMS and the development of micro-/ nanotechnologies**
- **Takes part in the ellaboration of RDI projects in the National and European Programmes and in the open subsequent calls, as coordinator and/or partner**
- **Takes part in the innitiation and organization of Technological Platforms, on a wide pallete of fields, similar to the European ones (member of EUROP and EUROP – RO), develops research activities, marketing strategies and training activities, information dissemination processes**

Members “NANOMECATRONICA”

FOUNDER MEMBERS

- **INCD - Mechatronics and Measurement Technique**
- **UPB - Faculty of Mechanical and Mechatronics Engineering**

MEMBERS

- **"Gheorghe Asachi" Technical University of Iasi**
- **QUATRO PRODCOM SRL, ILFOV**
- **SC PRO OPTICA SA, Bucharest**
- **Politehnica University Timisoara**
- **Transilvania University Brasov**
- **Valahia University Targoviste**
- **Technical University of Cluj—Napoca**

ROManian NETwork for MIcro-and NAnoFABrication

- **Network addresses, generally, to the innovative SMEs in Romania**
- **ROMNET-MINAFAB network will draw on course other research institutes and are not excluded cooperation with universities**

OBIECTIVES

- **to provide the industry comprehensive facilities for nanomanufacturing**
- **to develop large projects, with clearly defined goals**
- **action by providing expertise and equipment, making transparent offers to the domestic and foreign users**
- **collaboration with foreign scientific environment, with the Romanian scientists that left the country**
- **a common platform, the micro and nanotechnologies, with a very broad spectrum, from precision mechanics to nanoelectronics**

ROManian NETwork for MIcro-and NAnoFABrication

MEMBERS

- **National Institute of Research and Development in Microtechnologies, Bucharest (IMT Bucharest)**
- **National Institute of Research and Development in Mechatronics and Measurement Technique Bucharest (INCDMTM Bucharest)**
- **National Institute of Research and Development for Electrical Engineering AS (ICPE-CA Bucharest)**

ROManian NETwork for MIcro-and NAnoFABrication

- **INCDMTM Bucharest participates in the Network ROMNET MINAFAB bringing an important contribution to national development of the micro-nanotechnologies domain providing advanced facilities with immediate application in industry.**

- **Micro-mechatronic products by INCDMTM made with an equipment for micro- and nano-processing with laser beam by the sintering method**

Aplications:

- functional prototypes used in the industry, casts, individual components: DirectMetal20 - bronze-based, maraging steel (1.2709), Stainless steel 17-4 (1.4542), Stainless steel PH1
- Bio-medical implantable devices and functional prototyping for the automobile industry and the airspace industry: CobaltCrom MP1 Super-alloy, Titan Ti64, Titan Ti64ELI, Genuine Titan

ROManian NETwork for MIcro-and NAnoFABrication

Electron Beam Lithography and nanoengineering workstation- Raith e_Line from RAITH GmbH (IMT- Bucharest).

The state-of-the-art e_LiNE electron column matches perfectly with a number of key applications in: Nanoelectroniccs, Photonic Crystals (PCs), Difractive Optical Elements (DOE), CNTs interconections, nanodevices and nanosystems for fundamental research

Industrial applications (ICPE-CA): automatic non-distructive testing system of railway safety elements based on nano-structured magnetic sensors

- sensor: rows of 8 nanostructured sensors
- used proceed: magnetic flux

The first system was implemented at SC Atelierele CFR Grivita SA.

INCDMTM Bucharest

Organized events

- **SIMECA 2007 International Symposium - „Competitivity Increase throughout Scientific Research and Technological Innovation”**
  - One of the topics was Nanometry and nanotechnologies
- **MECAHITECH '09 - 1st International Conference on Innovations, Recent Trends and Challenges in Mechatronics, Mechanical Engineering and New High-Tech Products Development**
  - Topics: nano-mechatronic systems; nano-robotics

Proposals for future realizations

- **research for nanometric positioning and measurement equipments**
- **research in nanobiotechnology array**
- **research in micro-/ nanotribology array**

THANK YOU FOR YOUR ATTENTION!

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