NanoSpain Conf 2017

07-10, March 2017 San Sebastian (Spain)

LABORATORY OF NANOTECHNOLOGY

Development of new models and systems to micro- and nanoscale supported in high-precise functional replication of the clone instrumentation of MEMS and NEMS as products of the researchs of the Nanotechnology Laboratory FOSUNAB

Research Prof. : Dr.Sc. Ing. ANTONIO FAUSTINO MUÑOZ MONER Ph.D of Control and Mechatronics Research Group
Autonomous University of Bucaramanga Colombia

Dr. Jaime Castillo León, Research Prof.
Nano Bio Integrated System Group (NaBIS) Technical
University of Denmark DTU

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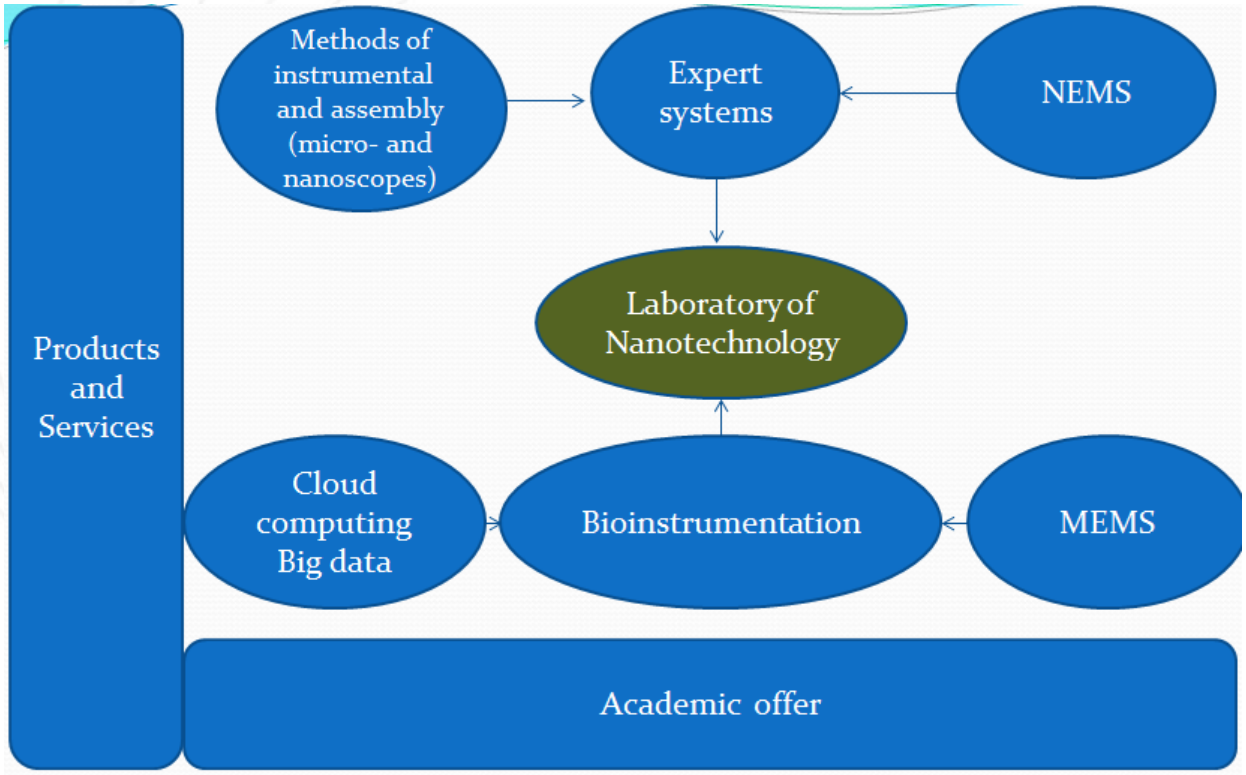
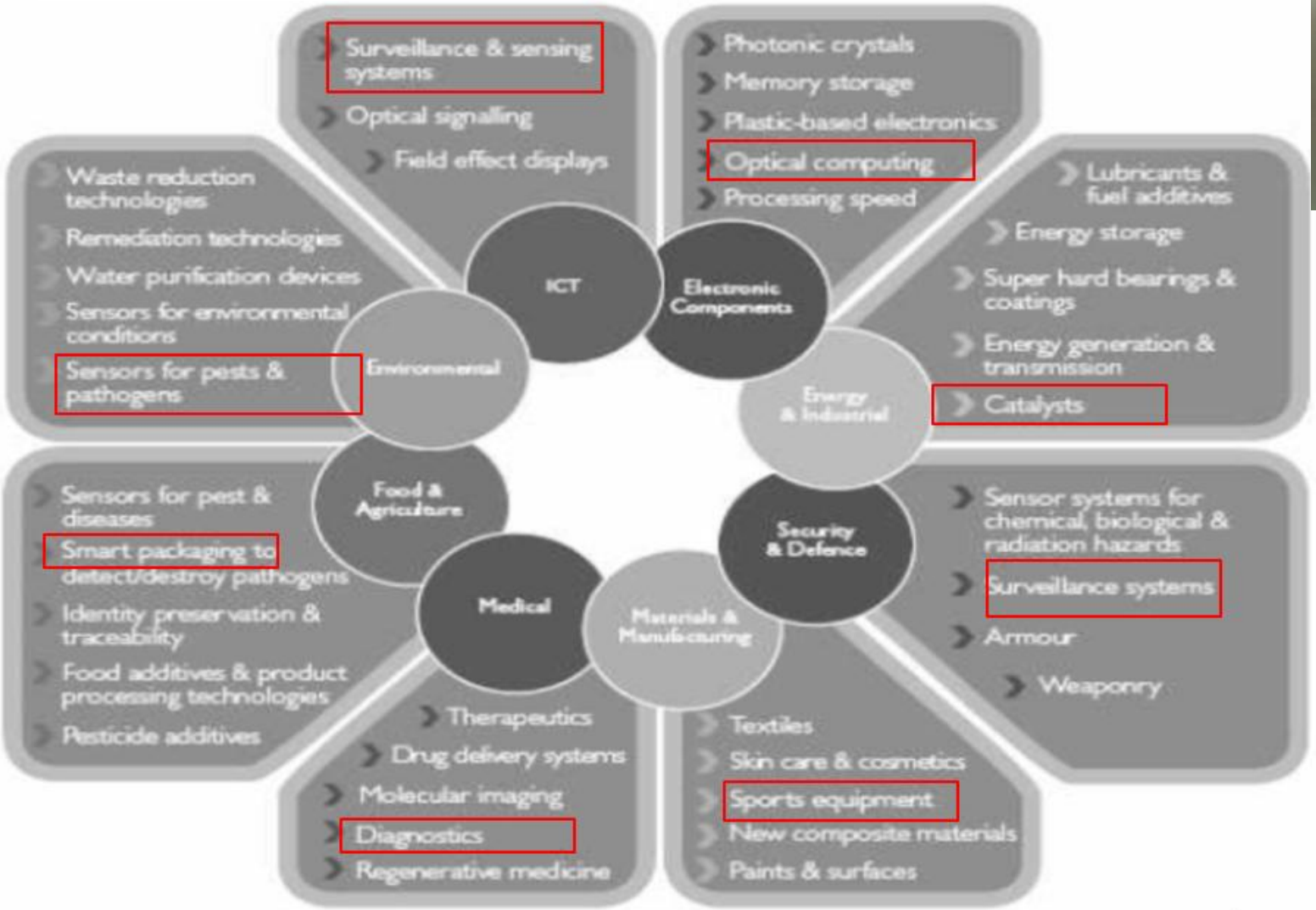
STRUCTURE:




CAMARA


Surveillance & sensing systems
Optical signalling
Field effect displays
Photonic crystals
Memory storage
Plastic-based electronics
Optical computing
Processing speed
Waste reduction technologies
Remediation technologies
Water purification devices
Sensors for environmental conditions
Sensors for pests & pathogens
ICT
Electronic Components
Environmental
Energy & Industrial
Lubricants & fuel additives
Energy storage
Super hard bearings & coatings
Energy generation & transmission
Catalysts
Food & Agriculture
Security & Defence
Medical
Materials & Manufacturing
Sensors for pest & diseases
Smart packaging to detect/destroy pathogens
Identity preservation & traceability
Food additives & product processing technologies
Pesticide additives
Sensor systems for chemical, biological & radiation hazards
Surveillance systems
Armour
Weaponry
Therapeutics
Drug delivery systems
Molecular imaging
Diagnostics
Regenerative medicine
Textiles
Skin care & cosmetics
Sports equipment
New composite materials
Paints & surfaces

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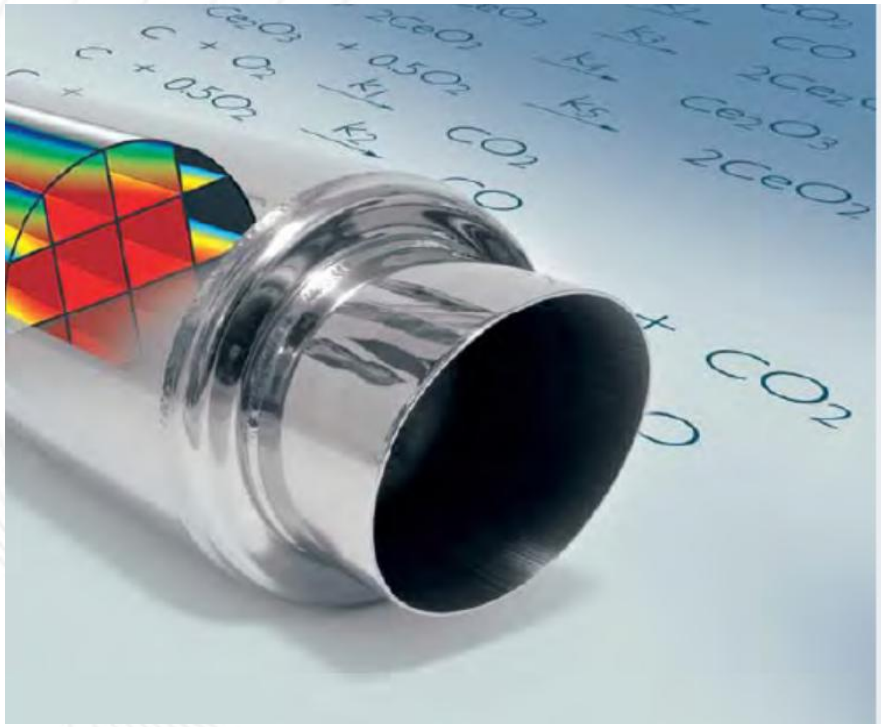
- **Nanocatalysis**
  - Preparation
  - Size Effects
  - Shape Effect
  - Support Materials

- **Some Recent Advances**
  - Nanocatalyst Preparation



APPLICATIONS

- Batch reactors, fermenters, and crystallizers
- Biochemistry and food science
- Chemical reactor sizing and optimization
- Chromatography and electrophoresis
- Cyclones, separators, scrubbers, and leaching units
- Exhaust after-treatment and emission control
- Filtration and sedimentation
- Kinetics modeling in chemical reactors
- Microfluidics and lab-on-chip devices
- Multicomponent and membrane transport
- Packed bed reactors
- Pharmaceutical synthesis
- Plug-flow and tubular reactors
- Polymerization kinetics and manufacture
- Pre-burners and internal combustion engines
- Reformers and catalytic converters
- Semiconductor manufacture and CVD
- Surface chemistry kinetics and adsorption

CHEMICAL

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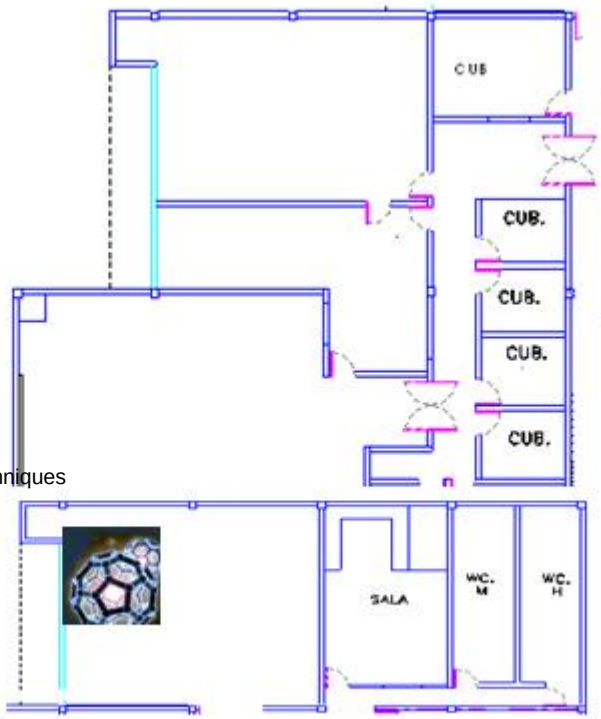
CINBBYA UNAB Ambiental

Advanced clean room based
polymer micro- and nanofabrication techniques



DTU Nanotech
Department of Micro- and Nanotechnology

LABORATORY OF NANOTECHNOLOGY

LABORATORY OF NANOTECHNOLOGY

MAJOR GOALS:

O1

- Development and implementation a laboratory of Nanotechnology that responds to the needs of research and technology transfer in the field of academic, institutional and regional development and which meets requirements of laboratory for the production and marketing of the products at the micro- and nanotechnology.

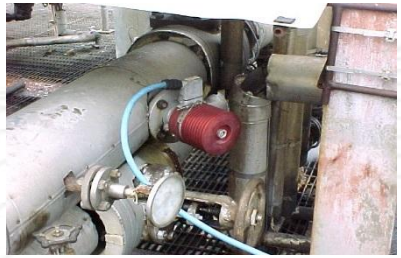
O2

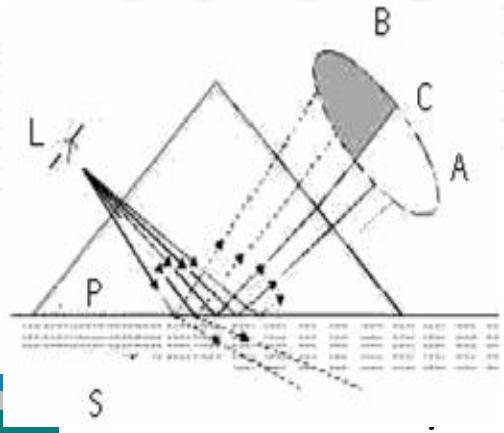
- Support research in micro- and nanotechnology and the development of new knowledge for the updating of the Mechatronics Engineering, Specialization in Industrial Automation, Masters in Industrial Automation and Mechatronics and a Doctorate in Engineering Programs of the Network Mutis-RUM

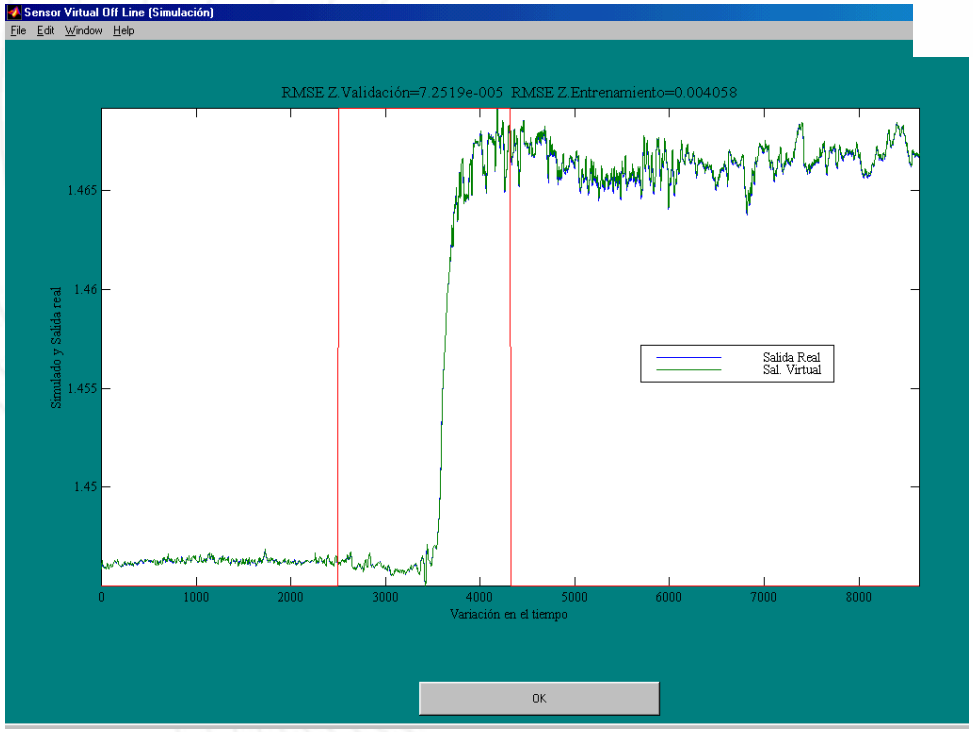
O3

- Produce and market the products obtained to the micro- and nanotechnology.
- perform laboratory tests for the identification and pursuit of products such as : Nanosensors(thermal sensors, piezoelectric, biochemist •Develop applications in tissue engineering sensitive membranes with biosensors for artificial skin, deployment of nanosensors in pavements of urban and national roads , sensitive coatings with nanosensors for automotive, axles, tires and others

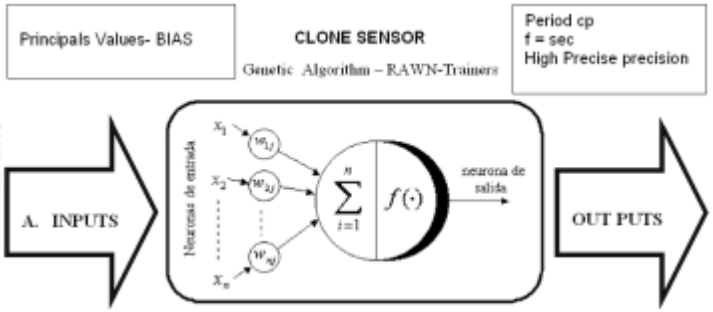
ON-LINE ANALYZER





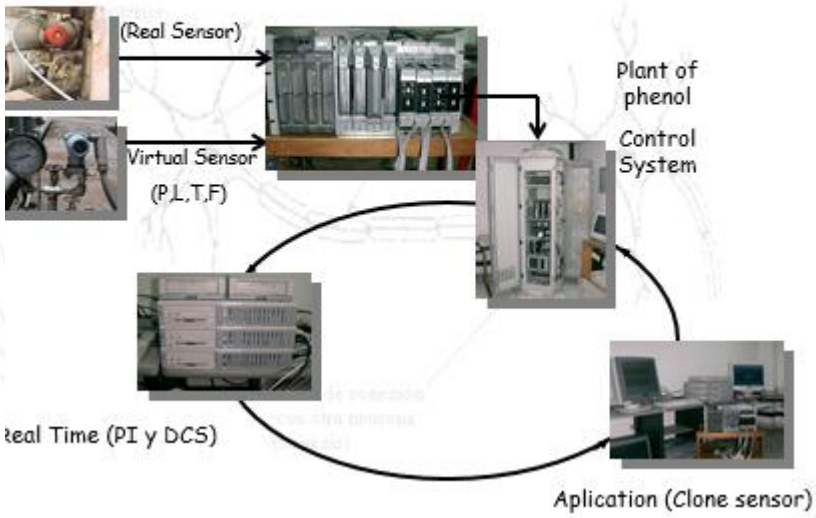


The real analyzer is replaced a cloned intelligent sensor , starting from the real device due to frequent flaws presented in the system. The sensor determines the index of viscosity of lubricant oils with phenol. For this, it calculates the refraction index starting from a sheaf of monochrome light and then processes that information through a linear relationship with the index of viscosity. This information constitutes the primary element for later prosecution on the part of the monitoring system, which registers and permanently deploys the obtained information of the cloned sensor.

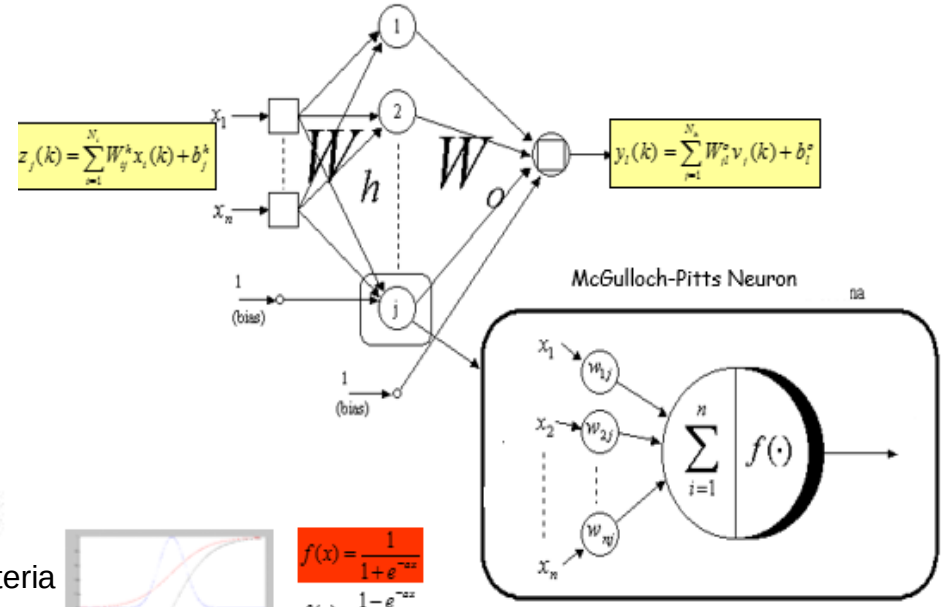


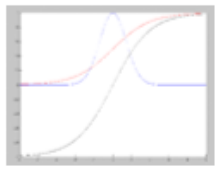
CLONING PROCESS

FIVE STAGES



NEURAL NETWORKS





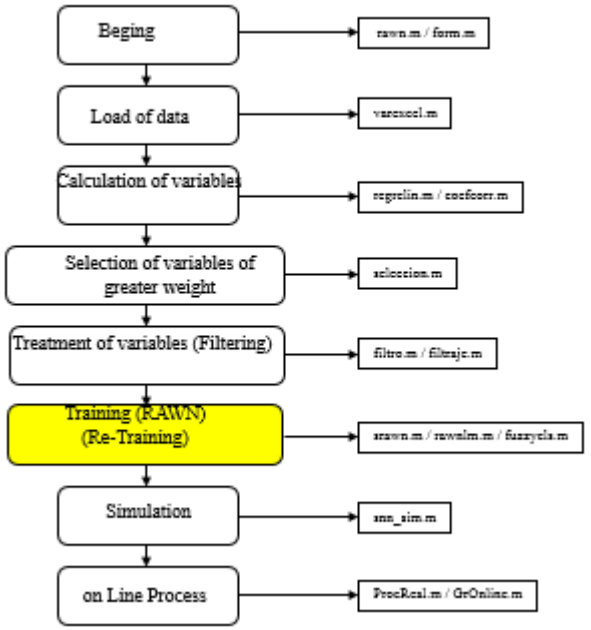
$$f(x)=\frac{1}{1+e^{-ax}}$$

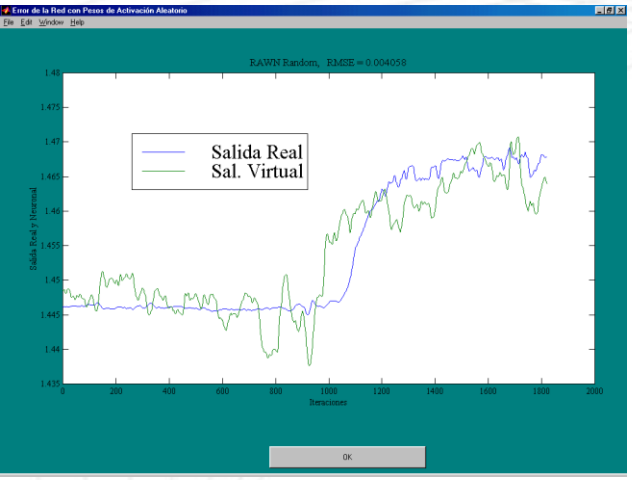
$$f(x)=\frac{1-e^{-ax}}{1+e^{-ax}}$$

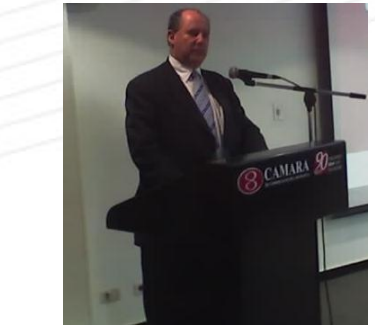
$$f(x)=e^{-ax^2}$$

The cloned by functional replication the utilities are criteria likeness that apply measured a dimensional and they include parametrical characteristics of the real devices to clone that allow a micro- nanosensors to reach a cloned version.

ALGORITHM - BLOCK DIAGRAM







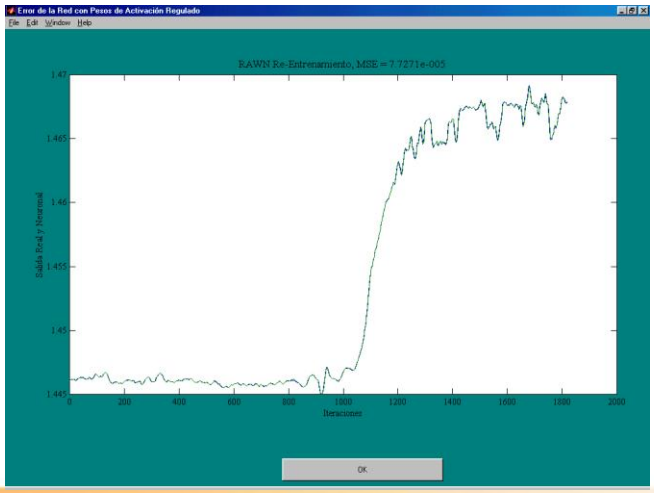
The example of a cloned sensor that determines the index of viscosity of lubricant oils with phenol for a monitoring system is briefly explained. The method include the application and interpretation of the genetic mapping that it contains; the codes of the functional structure of the sensor, the mapping is a group of bars of codes that describe the functional operative units of the micro-nanosensors, each operative unit is formed by unitary elements that represent a part of the operation of the sensors such as deviation of the angle of incidence, variation of the intensity of the sheaf of light

TRAINING

RMSE= 0.004058

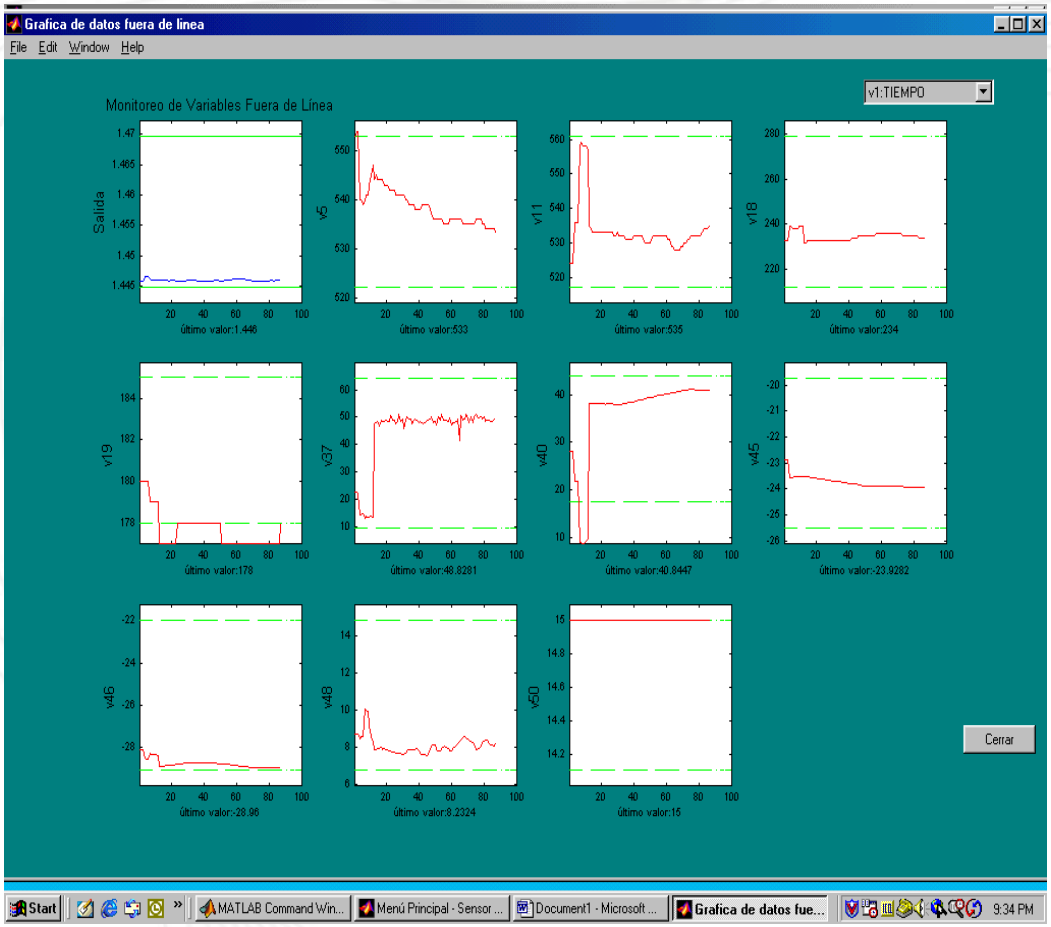
5 Neurons hidden layer
Act. Funct. : Sigmoide
Training 2500 a 4319

HIGH PRECISE:
+/- 0.0002



RMSE=
7.7271E-5

RE-TRAINING

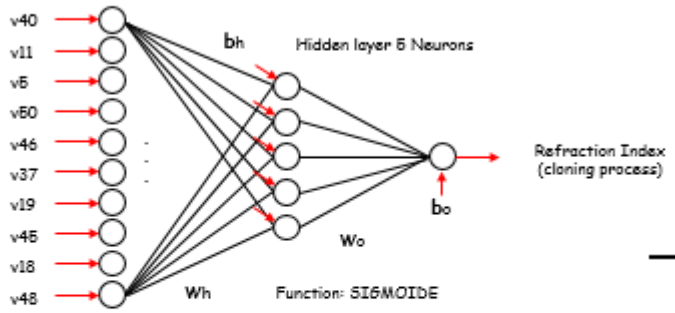


As a result, the software tool elaborated for such an end, can be used in the training of any system (entrance-exit) that seeks to be solved applying neural networks of this type. It has all the intermediate steps required as the attendance in the selection of variables for statistical methods that use the mathematical one required for the treatment of this class of stochastic processes, prove of possible linear, sign treatment to filter noise eliminate false data, training-validation and tests for simulation off line and on-line with the real process. The measurement of the RMS error is used and the Maximum opposing Error, mainly in the validation phase to be used as the comparison parameter that allows for the evaluation of the acting of the obtained pattern.

MODELS

NEURAL NETWORK

10 inputs:



purlin.m / srawn.m

W1, W2, B1, B2:
A1=funcAct(W1*X, B1)
Y1=fSalida(W2*A1,B2)

```
Y1=salida=fsalida(n,b)
[nr,nc]=size(n)
Salida=n+b*ones(1,nc)
end
```

MODELS

WEIGHTS INPUTS (5x10)
Wh

-0.0004	0.0001	-0.0013	0.0004	0.0012	0.0045	-0.01	0.0012	-0.0149	0.018
-0.0004	-0.0001	-0.0003	0.0004	-0.0062	-0.0097	0.0051	-0.0085	-0.0161	-0.0118
0.0001	-0.0006	0.0005	-0.0017	-0.0019	-0.0011	0.0058	-0.0011	0.024	-0.0115
0.0002	-0.0006	-0.0011	-0.0017	0.0018	-0.0014	0.0066	0.0048	-0.0175	-0.0198
-0.0002	-0.0002	-0.0013	-0.0011	0.0031	-0.0034	-0.0006	0.0088	0.02	-0.0186

BIAS INPUT (1x5)
bh

0.1705	0.038	0.3425	1.1589	0.0874

WEIGHTS OUTPUTS (5x1)
Wo

-0.2925
0.0356
0.0946
0.1099
0.0798

BIAS OUTPUTS (1x1)
bo

2.73

Table 1 - Experiment results for models

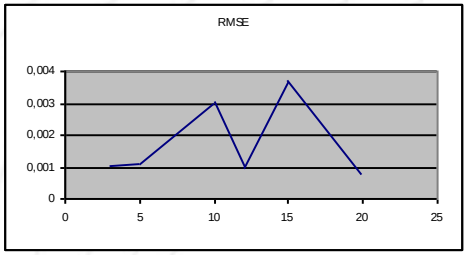


Figure 8 – RMSE

# NEUR	RMSE	MAXE
3	0.0010291	0.0027133
5	0.0011054	0.0024877
10	0.003029	0.012585
12	0.00096497	0.012741
15	0.0036674	0.0073696
20	0.00072544	0.0071936

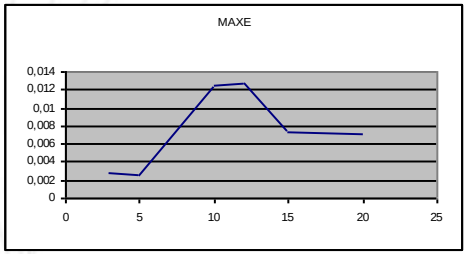


Figure 9 – MAXE

Table. 2 Results Expert Model

MODELO	#N	RMSE	MAXE
REGRESIÓN	10	0.0013473	0.0058143
CORRELAC-DISPERSION	5	0.0011054	0.0024877
EXPERTO	12	0.0016122	0.0035634

Muñoz F., Pardo A., (2004). “The technology of advanced control of applied artificial cloning to highly precise”. IEEE International Symposium on Intelligent Control, pp 714 – 718.

CONCLUSIONS

The use of the genetic mapping allows the design of quicker teams for the sequencing and with computer development the creation of the databases is possible to transmit, to store, to analyze and clone this information

The artificial neural networks are able to manage complex and not linear problems, they can process information very quickly and they reduce the required computers effort in the development intensive computer of model, finding functional forms for empiric models as shown by that of our case with the cloned sensor.

In a alone artificial neural networks entrance exit data are needed so that the net recognizes a pattern wrapped in the mapping from the entrance variables to the answer of the exit. It is true that the neural networks have been described as a black box to solve problems, but the ability of the neural networks to give quick and precise values for the case of the process engineers makes them a very useful tool. Its ability to execute the inverse problem easily of exchanging the entrance vectors and the exit of the neural networks, is also constituted in another advantage for the analysis and diagnosis of a given system.
One can obtain an excellent genetic mapping with neural networks in advance with only a layer of non lineal neurons taking the activation random values, continued by a training of the values of having left by ordinary minimum square. Static and dynamic examples show the feasibility of this approach. As in any non lineal identification, care should be taken to make sure that the excitement entrance used for identification, be in the same range of frequency and width like in the application. Later improvements they can be obtained for regularization of the values activation

LABORATORY OF NANOTECHNOLOGY

Competitive Advantage to research **:**

INNOVATION

Keep Santander industry on the leading edge of implementing micro- and nanotechnology (New Knowledge)

- Hardware
- Software
- Expert systems

Continue to generate micro- and nanotechnology new products

- Micro- and nanosensors
- Micro- and nanoactuators
- Methods of instrumental analysis (micro- and nanoscopes)

Alliance for development

- Alliance for development with FOSCAL, CORASFALTOS, TRANSEJES, ECOPETROL and others

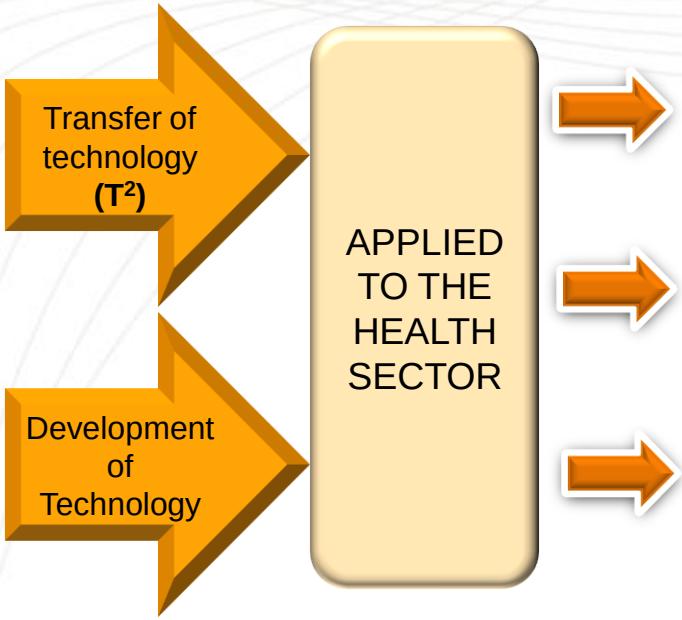
01

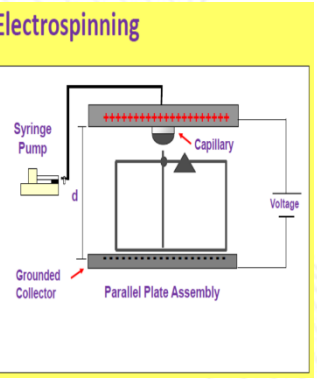
LABORATORY OF NANOTECHNOLOGY

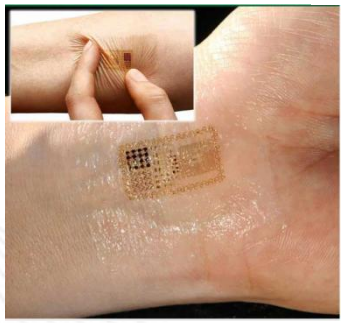
Intelligent electro-stimulator, which it uses as electrodes, the needles of acupuncture and applies a methodology based on the artificial cloning of sensors and automatic controllers, extended to biomedical teams, with wireless broadcast, of the electrical signs of electrical of electro-stimulation.

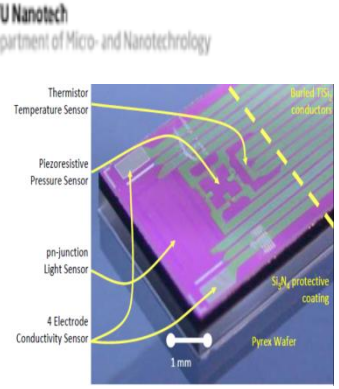
New Systems of Measurement and Control by Models based on Nanotechnology Transmission of information for the design of Artificial Skin with nanoinstrumentation manufactured by electrospinning for the coating of Prosthesis of Hand and Leg In for Disabled.

Development of a new methodology based in nanotech models according to a methodology for design , implementation of coatings and maintenance for the capture, processing, storage and data extraction of the artificial skin with nanoparticles coating limb prostheses of hand and leg in for disabled; and equipping it with a data acquisition system which takes their biological signals of its couple and then be replied in the prosthesis using artificial intelligence









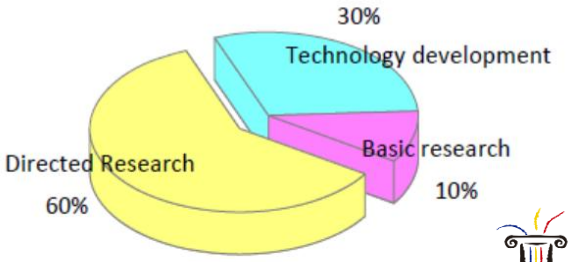
02

LABORATORY OF NANOTECHNOLOGY

Program´s support

- Mechatronics Engineering
- Specialization in Industrial Automation
- Masters in Industrial Automation and Mechatronics
- Doctorate Program in Engineering

Research topics arise from discussions with industry to avoid developing solutions looking for a problem.



Reference: Market Study Surveys Some Results Atenea 2014

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03

LABORATORY OF NANOTECHNOLOGY

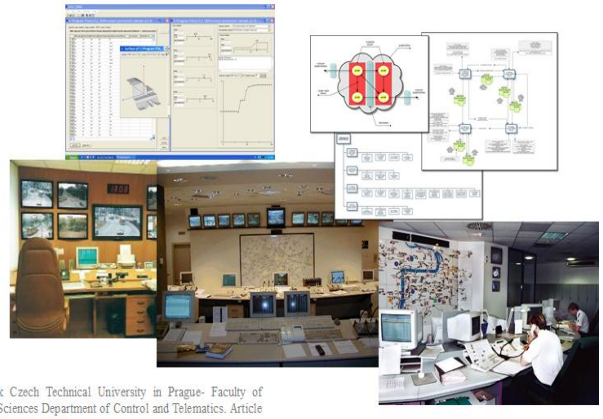
NEW NANOINSTRUMENTATION DESIGN AND DEVELOPMENT METHODOLOGY TO MONITORING AND CONTROLLING SMART HIGWAYS OF THE STREET NETWORK OF COLOMBIA (Project)

APPLIED TO THE INDUSTRIAL SECTOR

Intelligent control systems based on fuzzy logic to evaluate the behavior of the pavements in real time through nanosensors, humidity, temperature and vehicular traffic; in this research project has been designing a intelligent control to monitor the associated instrumentation to the most important variables in the urban roads, in order to predict the damage on the road to the staff responsible for the maintenance of these; taking as a point of reference the tests designed with standards INVIAS in the laboratory of CORASFALTOS

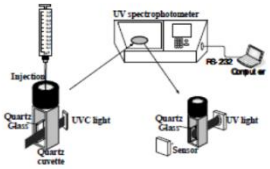
CORASFALTOS

Intelligent Transportation System

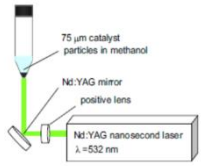


Miroslav Svitek Czech Technical University in Prague- Faculty of Transportation Sciences Department of Control and Telematics. Article IEEE Transport Bogota. 2012

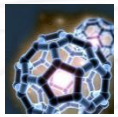
Nano Catalyst



Schematic diagram of the experiment device



Experimental setup for nanocatalyst particle fabrication.



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Research Prof. : Dr.Sc. Ing. ANTONIO FAUSTINO MUÑOZ MONER Ph.D of Control and Mechatronics Research Group
Autonomous University of Bucaramanga Colombia

Dr. Jaime Castillo León, Research Prof.
Nano Bio Integrated System Group (NaBIS) Technical
University of Denmark DTU