"*Gheorghe Asachi*" Technical University of Iasi, Romania

Faculty of Mechanical Engineering

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Automotive Laboratory

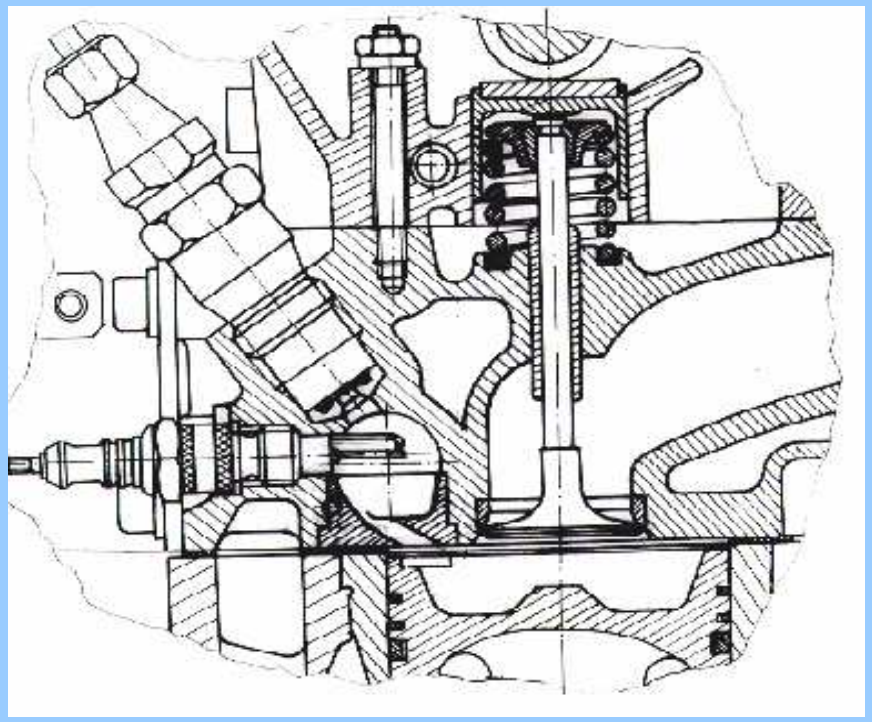
Faculty of Mechanical Engineering

Student Formula Racing Car

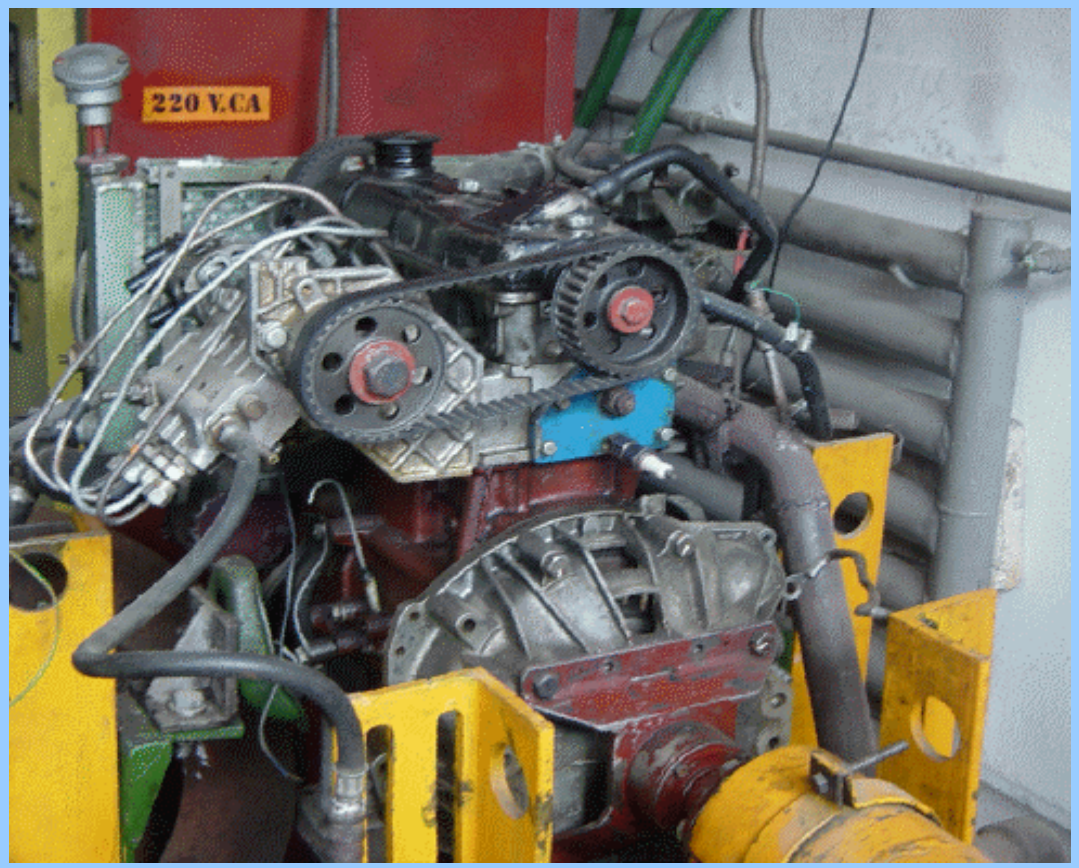
Sport car concept

Buggy concept

Howercraft concept



Researches in stratified charge engines



Main equipments

Leica optics HCS microscope

- lens with magnifications from 1.6x to 250x
- ocular's magnifications: 10X, 12,5x, 16x, 25x
- possibility of processing the image (grain dimensions, quantitative analysis, chemical elements identification and marking them with different colors, etc)
- glow contrast and polarization reflected light with one hand
- 3 flat plates of 247/230mm which can hold a sample up to 8 kg
- Metallographic optical microscope Leica DMI5000 M
- Photomicrography with attachment system Leica MPS 30, 60, DM LD

Metallographic optical microscope Leica DMI5000 M

Electronic Microscope QUANTA 200 3D, produced by FEI Netherlands

- double electron and ion beam.
- maximum of magnification is 3000000x (2990000x)
- 3 detectors of secondary electrons, optimized for each way of work
- 2 spread electrons detectors, optimized to work on all pressure domains, and one spread electrons detector for special experiments, which involves sample warming until 1000°C
- Provides simultaneous presentation of secondary electrons images and of spread electrons on every way of work
- EDAX module, with the possibility of EDS analysis and crystallographic recognition.

Main equipments

X'PERT PRO MRD Difractometer, produced by PANalytical Netherlands

Main equipments

Specialty: Research and analysis for solid samples and (nano) powders routine analysis. The equipment allows realization of these measurements:

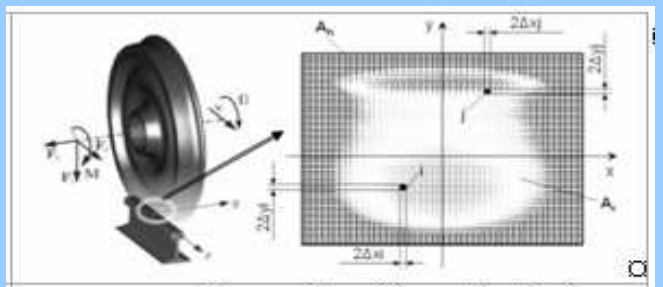
- determination of phases composition and crystallographic analysis
- microstrain analysis (quantitative)
- analysis of thin films (composition, thickness, roughness, density).X'PERT PRO MRD Difractometer
- determination of average size, distribution, size, specific surface area structural characteristics of nanopowders etc.

Plasma spraying process is made with a gun which is consists of a copper anode (nozzle) and a tungsten cathode. Inert (plasma) is passing through the nozzle, near the cathode, and at a high voltage discharge it forms a continuous current arc that ionizes the plasma gas, forming plasma. At the exit of the nozzle gas ions recombines, yielding the energy absorbed in a very short time, leading to the formation of a plasma jet with a temperature of 10,000-16,000°C. The powder is injected directly into the plasma jet which accelerates it to the surface area. When it solidifies on the surface, we obtain the coating. The installation gives the possibility of metallic and ceramic deposition.

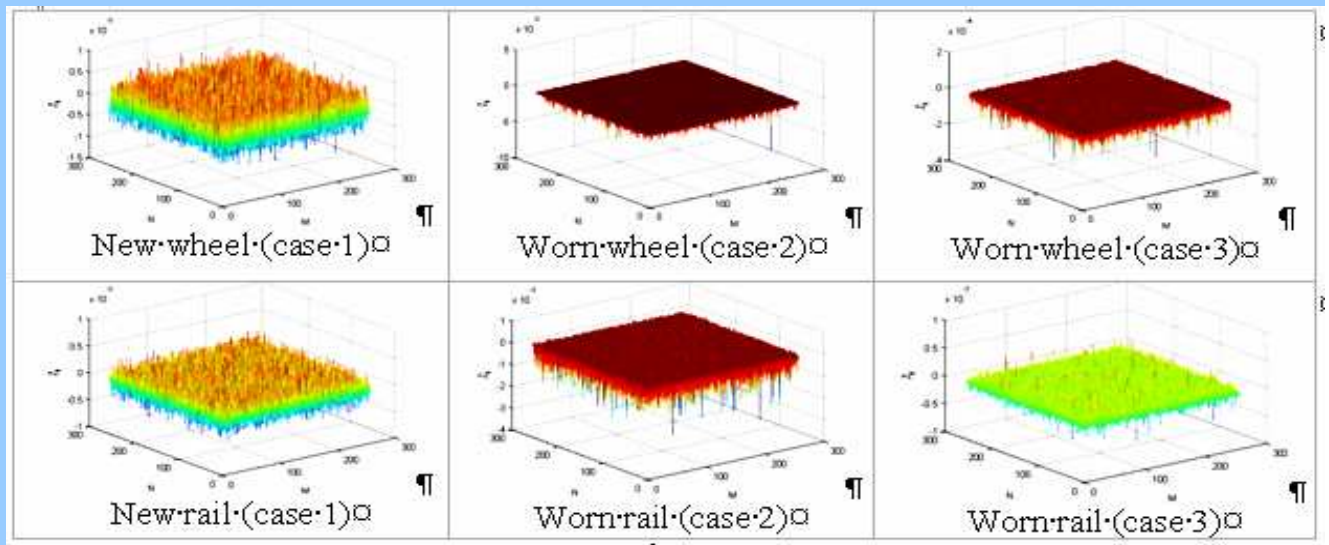
Main equipments

SPRAYWIZARD-9MCE plasma spraying deposition facility, produced by Sulzer-Metco

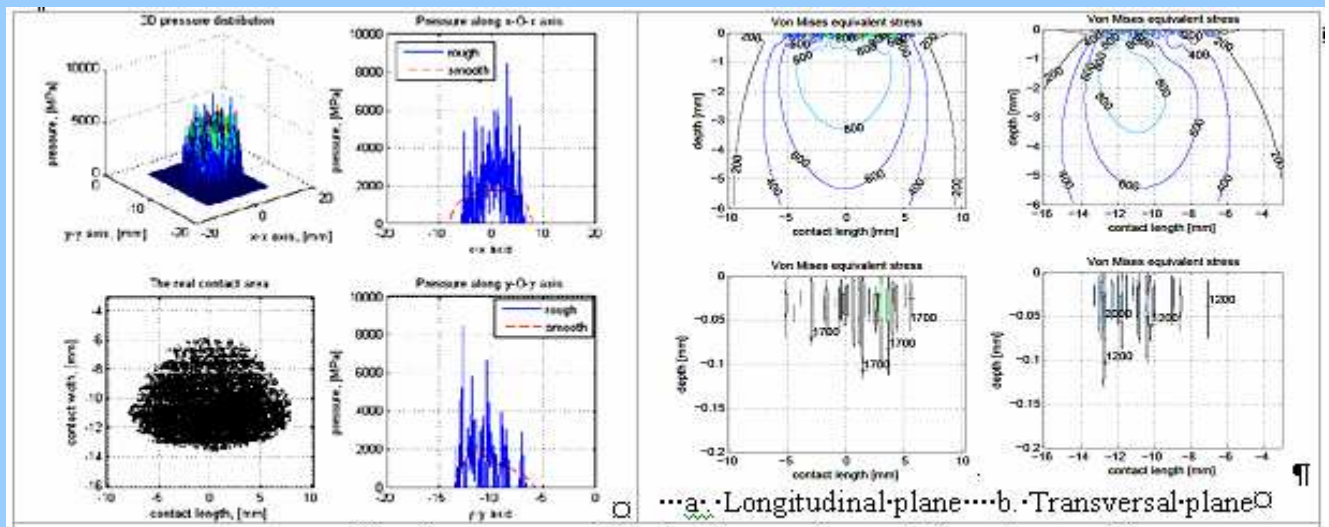
ROLE PLAYED BY ROUGHNESS PARAMETERS ON PRESSURE AND STRESS DISTRIBUTIONS IN WHEEL-RAIL CONTACT



The real and hypothetical contact areas



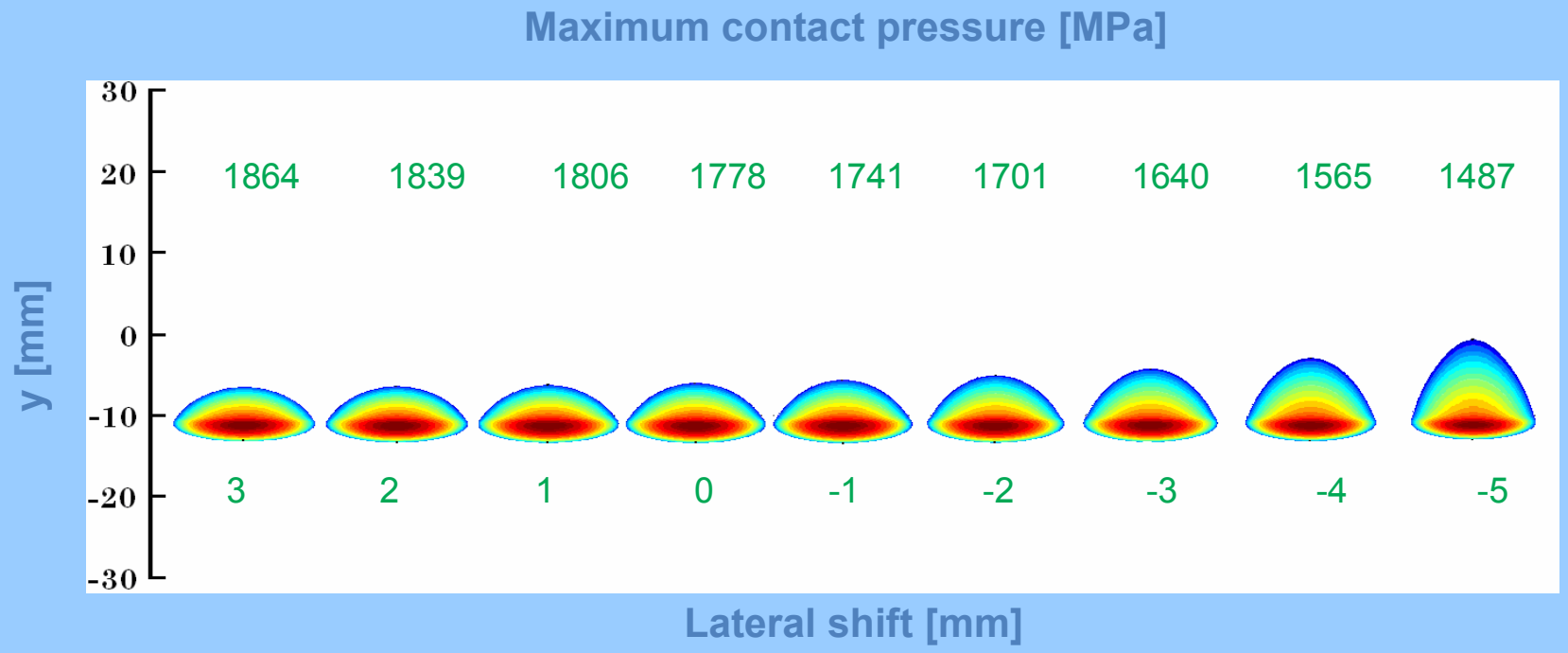
3D non-Gaussian roughness simulation



…a: Longitudinal plane…b. Transversal plane

Elastic pressure distributions and von Mises stresses – new rough surfaces, (case 1)

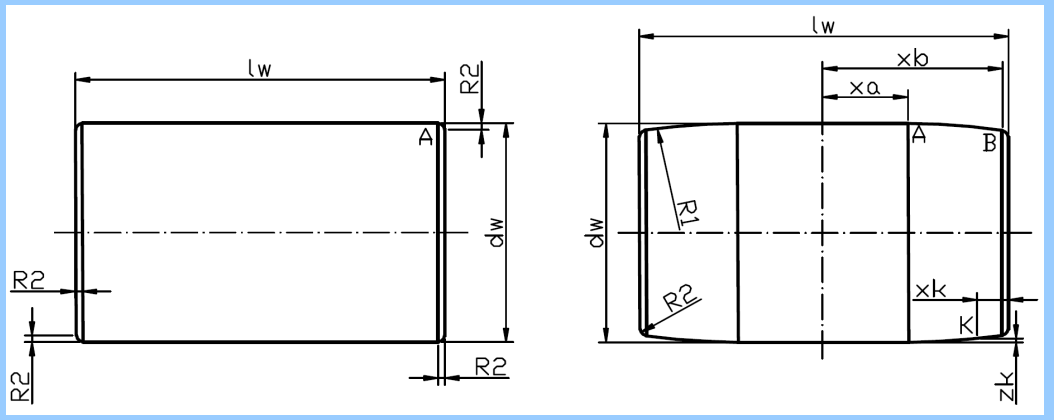
Contact areas and pressure distributions of the left wheel S1002-rail S60 pair. Rail inclination: 1/20



The class I discontinuities that exist along cylindrical-crowned roller profile generate high pressure peaks in pressure distributions that diminish considerably the modified rating life as is defined by ISO 16281-2008.
For a straight line profile and different cylindrical-crowned profiles is pointed out how a transient overload can influence pressure distributions and the modified rating life for normal loading conditions of a roller bearing.

PROFILE EVOLUTION IN RATING LIVES EVALUATION OF CYLINDRICAL ROLLER BEARINGS

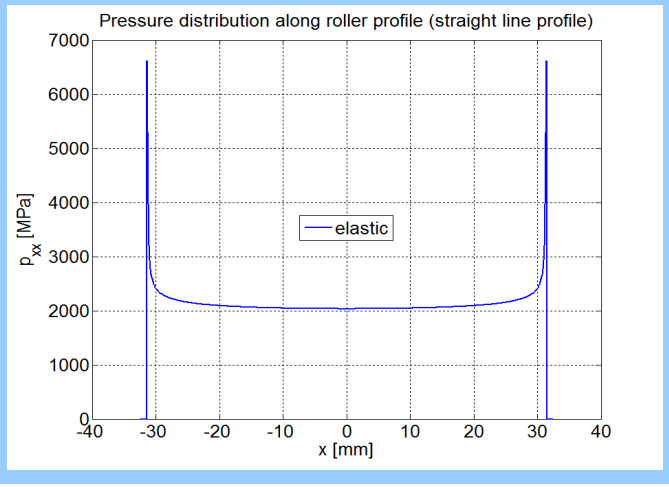
NJ2232 ROLLER BEARING CASE STUDY

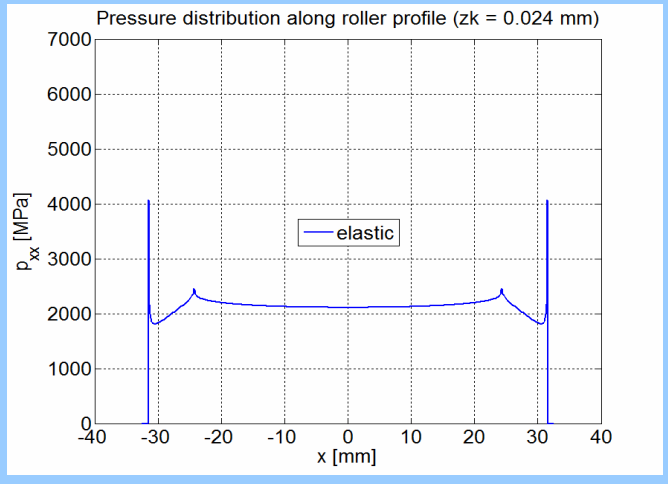


straight line profile

cylindrical-crowned profile

2D Elastic pressure distributions, F_R=450 kN

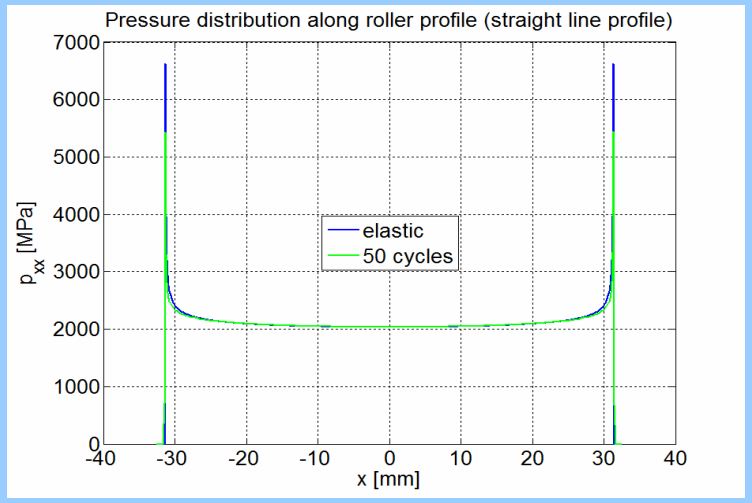




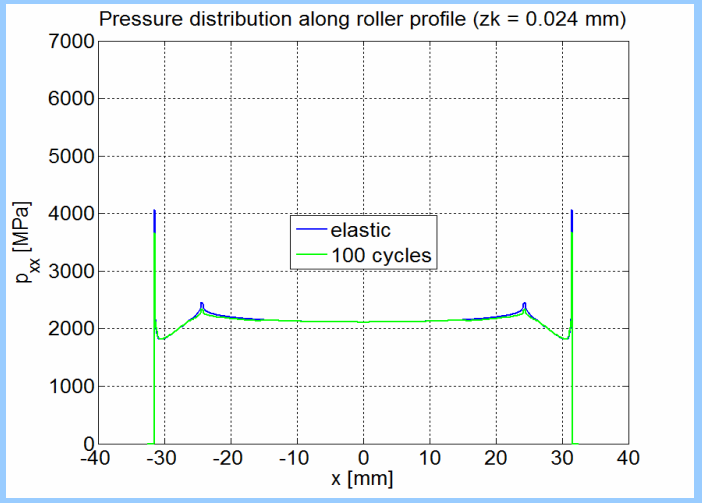
PROFILE EVOLUTION IN RATING LIVES EVALUATION OF CYLINDRICAL ROLLER BEARINGS

PRESSURE DISTRIBUTIONS, TRANSIENT OVERLOAD CONDITIONS

F_R=450 kN

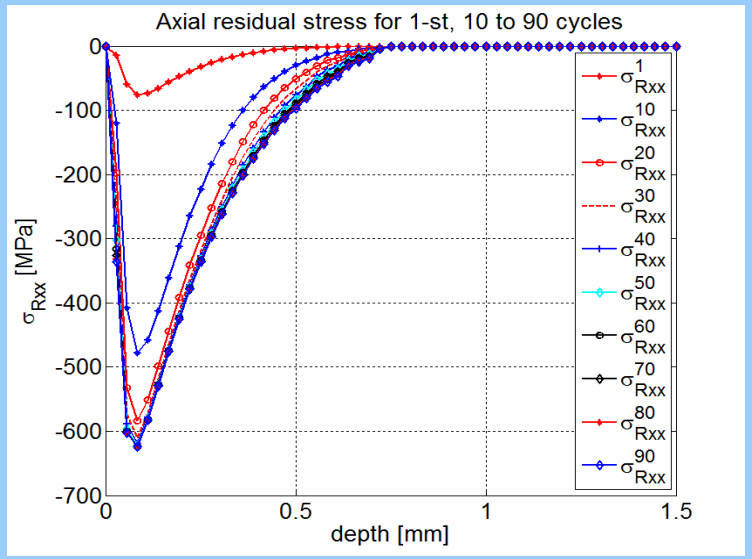


straight line profile

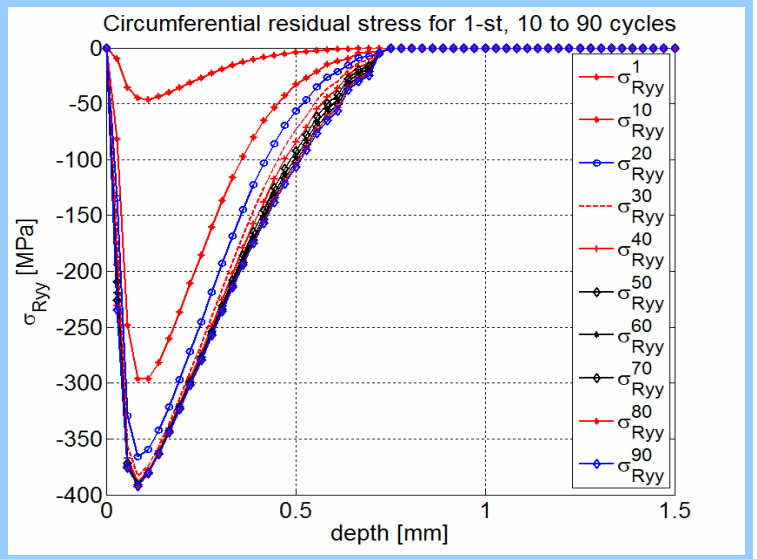


crowned profile: R1=8100 mm, zk=0.024 mm

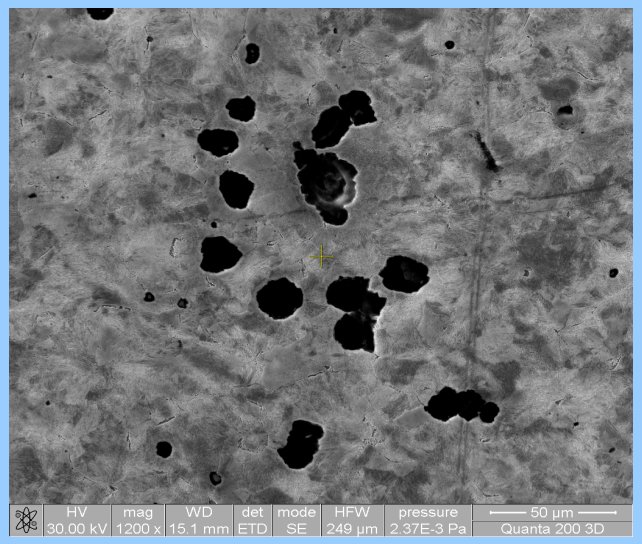
RESIDUAL STRESSES DISTRIBUTIONS

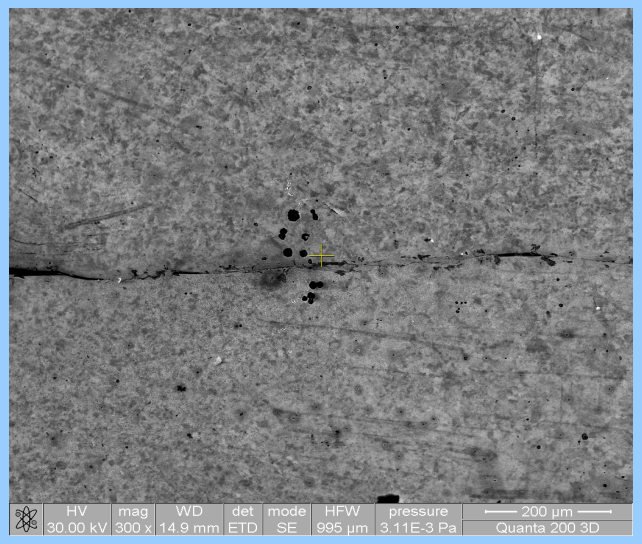


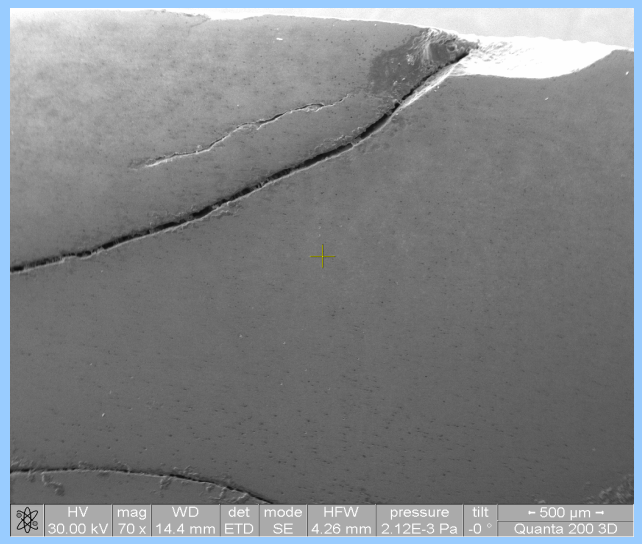
axial direction



circumferential direction







Microstructure of wear R65 rail

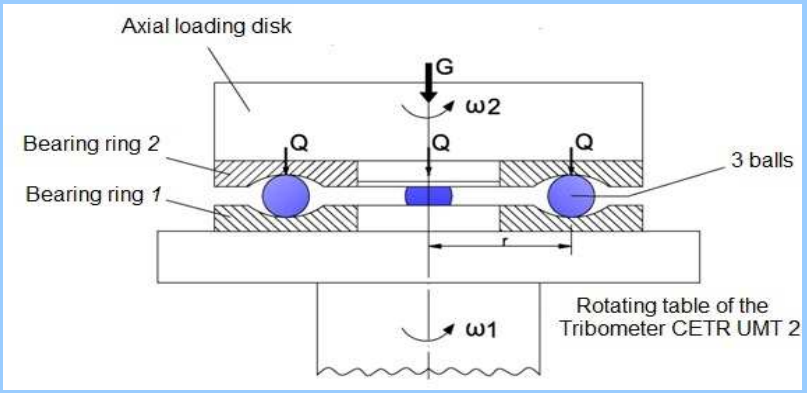
(pores and cracks)

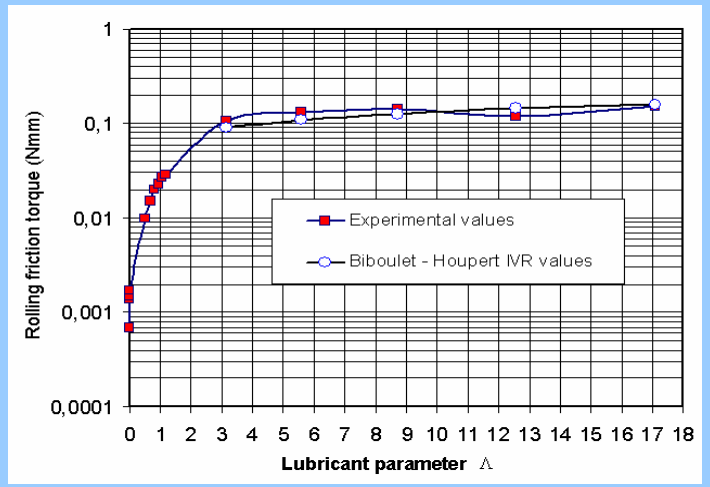
THE INFLUENCE OF THE LUBRICANT FILM PARAMETER Λ ON ROLLING FRICTION TORQUE IN LOW LOADED BALL-RACES CONTACTS

Analytical model for rolling friction torque in ball-race contacts

Experimental tests with an original 3 balls tribometer

Variation of the rolling friction torque between a 7.938 mm diameter ball and raceway in 51205 axial ball bearing vs. lubricant parameter Λ



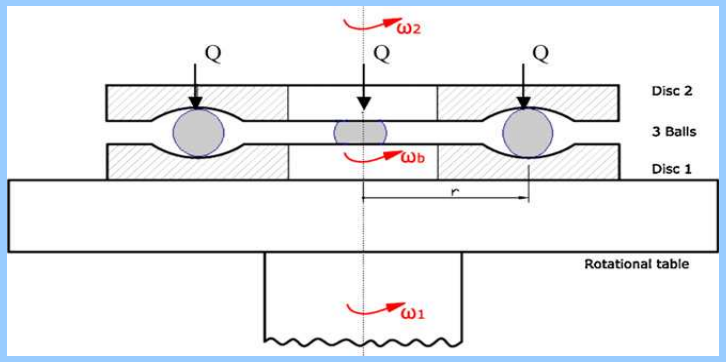


References:

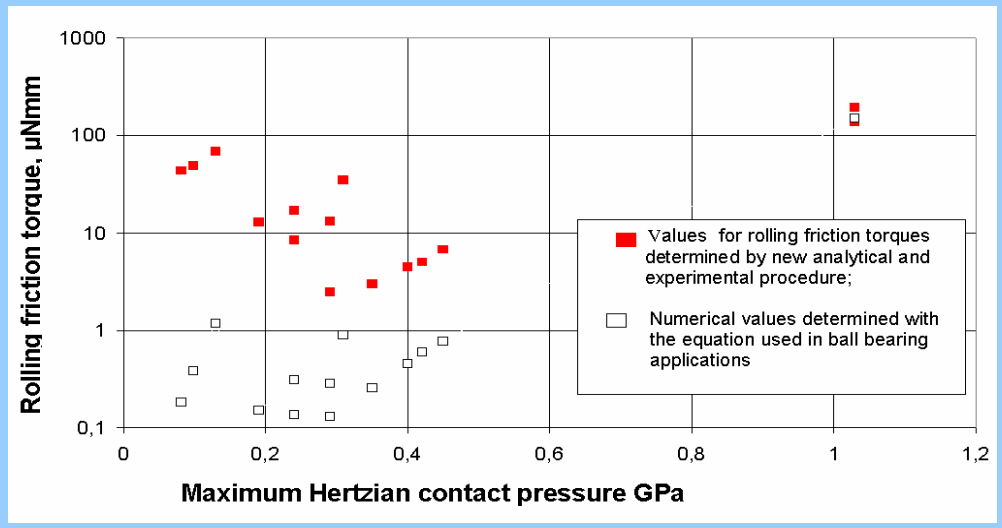
1. M.R. Balan, 2011, *Theoretical and experimental contributions concerning contact behaviour of rough surfaces*, **PhD Thesis**;
2. M. R. Balan, D.N. Olaru*; New methodology to evaluate rolling friction torque in dry and mixed lubrication regimes*, Proc. of the 16th International Conference Modern Technologies, Quality and Innovation – **ModTech 2012 – New face of TMCR**,Vol.I, *pp.65-68;*24-26 May 2012, Sinaia, Romania;

NEW METHODOLOGY TO DETERMINE ROLLING FRICTION TORQUE IN MICRO BALL-RACE CONTACTS

Analytical model for rolling friction torque in micro ball-race contacts operatind in dry conditions
Experimental tests with an original 3 balls microtribometer



Variation of the rolling friction torque between a 1.588 mm diameter ball and raceway in 51000 axial ball bearing vs. Hertzian contact pressure



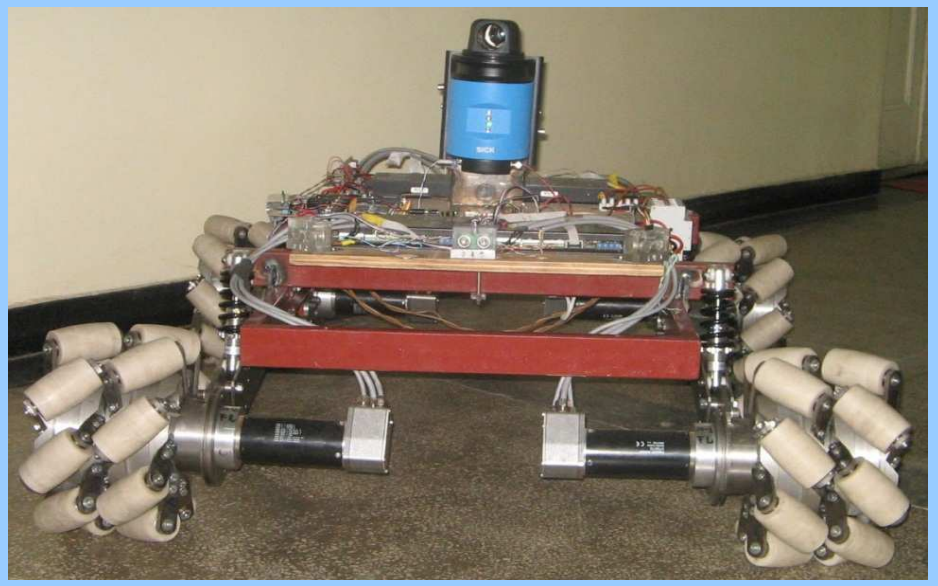
Conclusion: For low loaded micro ball-race contacts, the rolling friction torque in dry conditions determined by proposed methodology is higher that the rolling friction torque determined by equations used in ball bearing applications.

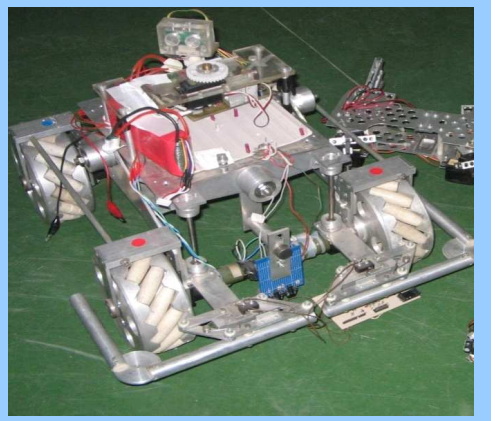
References:

1. **D.N.Olaru**., Stamate, C., Dumitraşcu, A., Prisăcaru, Gh.: *A New Microtribometer for Rolling Friction*, **WEAR**, 271 (5-6), pp.842-852, (2011);

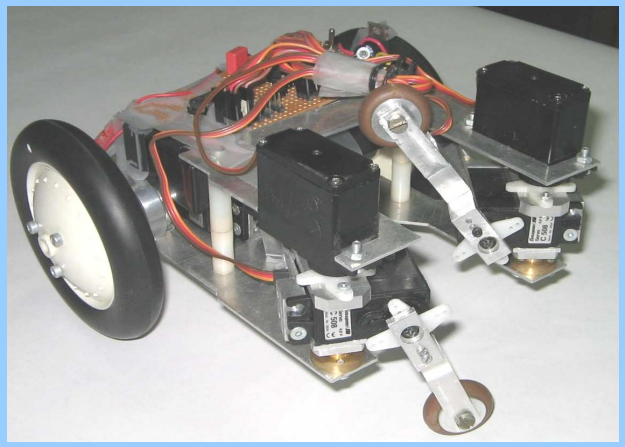
Developed Projects

Wheeled vehicles



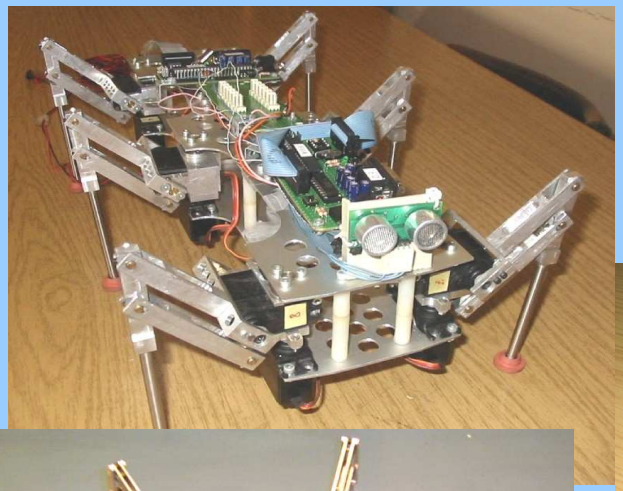


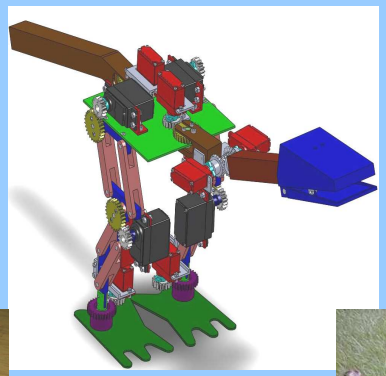
Hybrid locomotion micro - robot

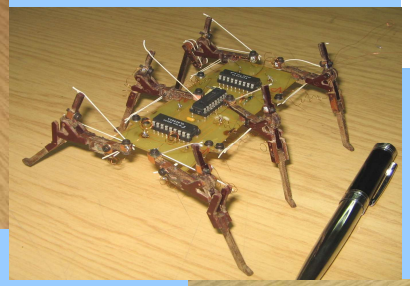


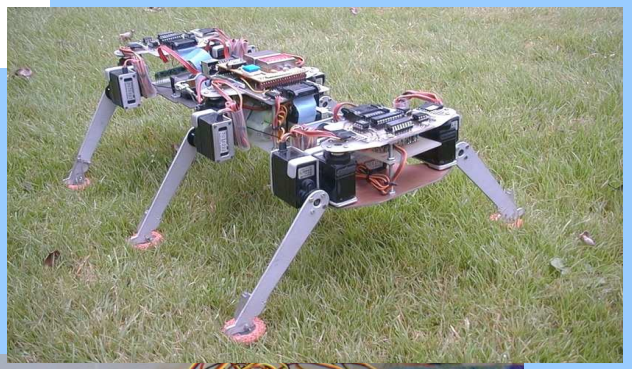
Developed Projects

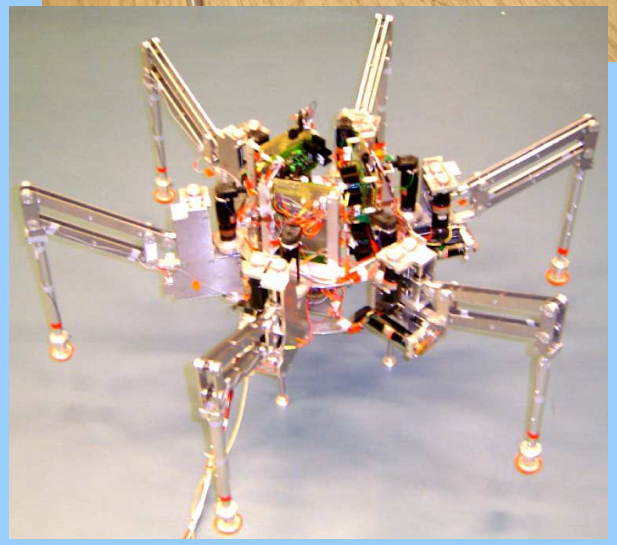
- Legged vehicles

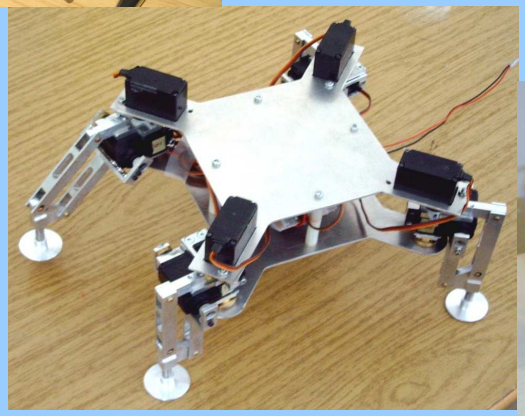


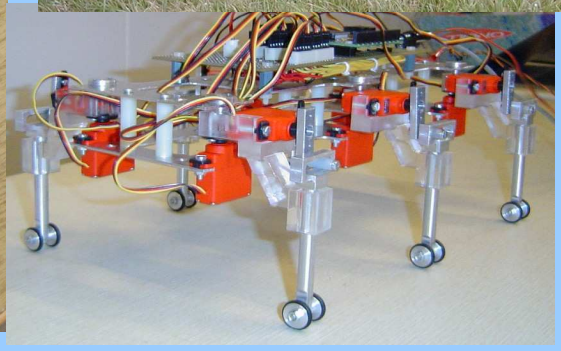






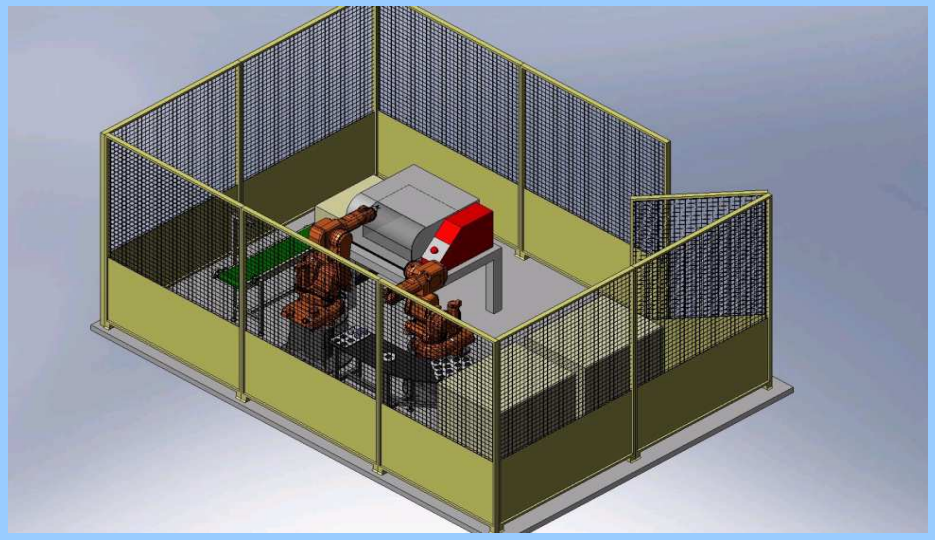






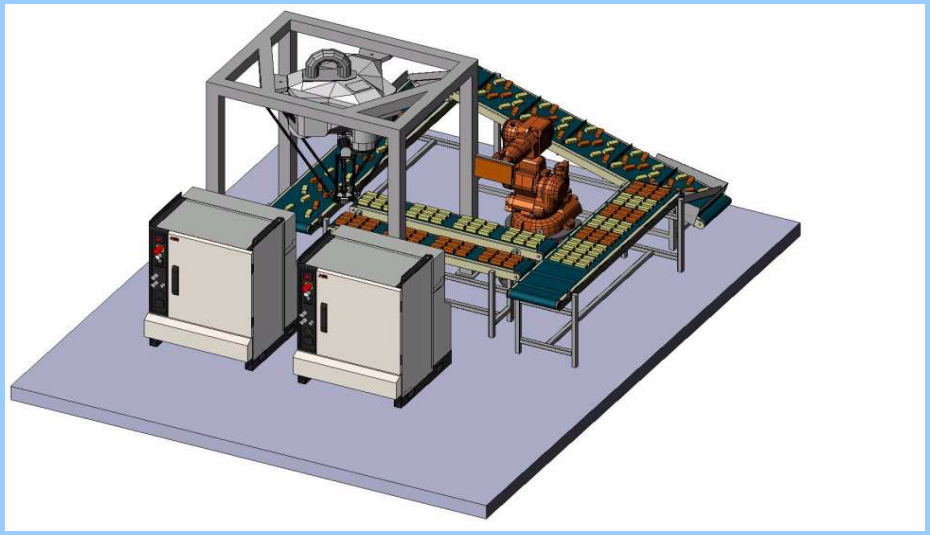
Facilities for education:

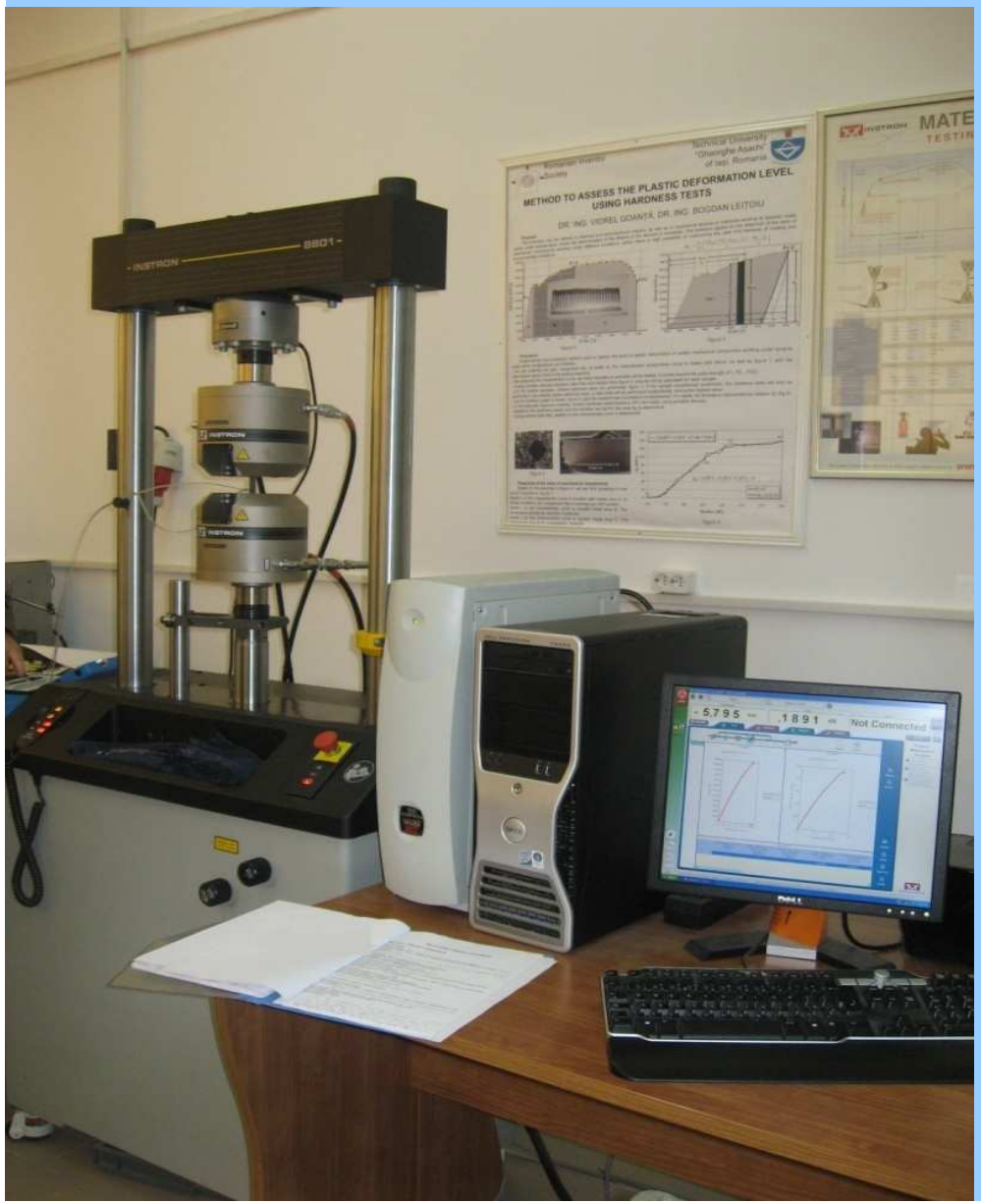
•Industrial Robotics Laboratory Computer Aided Manufacturing and Assembling System (2 IRB 140 serial manipulators, 1 CNC machine, conveyors, force control system, vision system)



Facilities for education:

•**Industrial Robotics Laboratory Computer Aided Sorting and Packaging System (1 IRB 140 serial manipulator, 1 IRB 360 parallel manipulator, conveyors, vision system)**





Instron 8801
universal testing machine

- **100 kN**
- **Hydraulic grips**

Used for:

- Static tests (tensile, compression, bending and shear–*Iosipescu* method)
- Dynamic tests
- Fatigue tests
- Fracture Mechanics tests

Visay LF/Z - 2
Polariscope
Photo Stress
(by reflection)

Used for:

- Instantly determine directions of principal stresses on the structure;
- Instantly calculate strain and stresses at any selected point;
- Locate Assembly Stresses, Residual Stresses, Yielding, and verify FEA.

Vishay P3
strain indicator
and recorder

Strain Gauges technique

- *ESAM Traveller 1* data acquisition system (master and slave units)
- Strain Measurements using Strain Gauges in Quarter, Half and Full Bridge Configuration – up to 24 Channels
- Displacement Measurements using Displacement Transducers
- Recording of Voltage and Current Signals from other Transducers etc.

Sensors: Load cells, displacement, accelerometers etc.

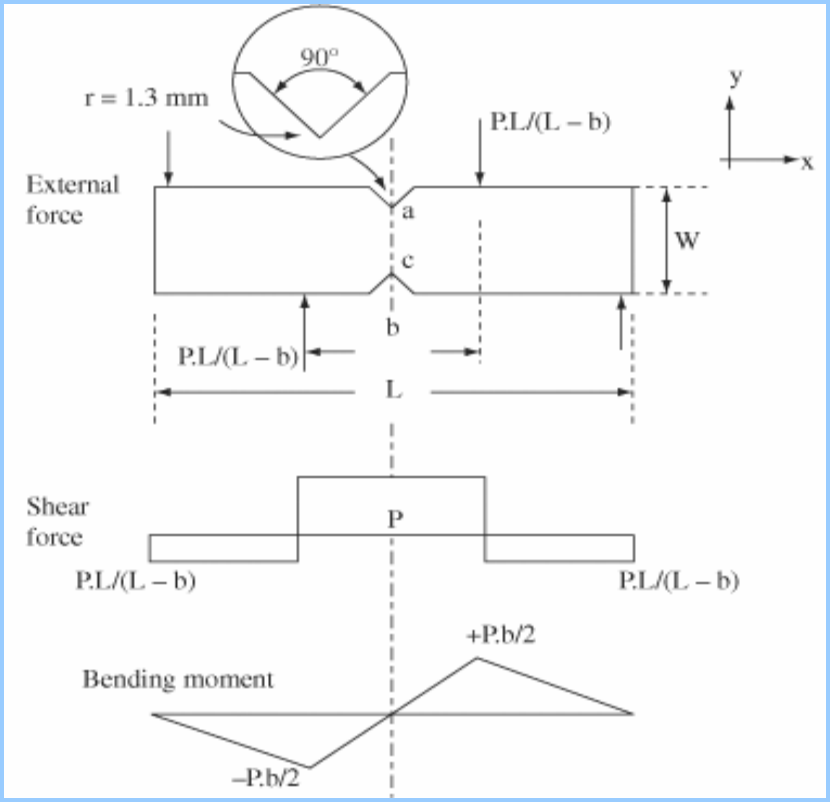
Sophisticated methods for errors evaluation (including integrating tendency of SG, FEA etc.)

Vishay RS200
milling guide

for Residual Stresses measurements

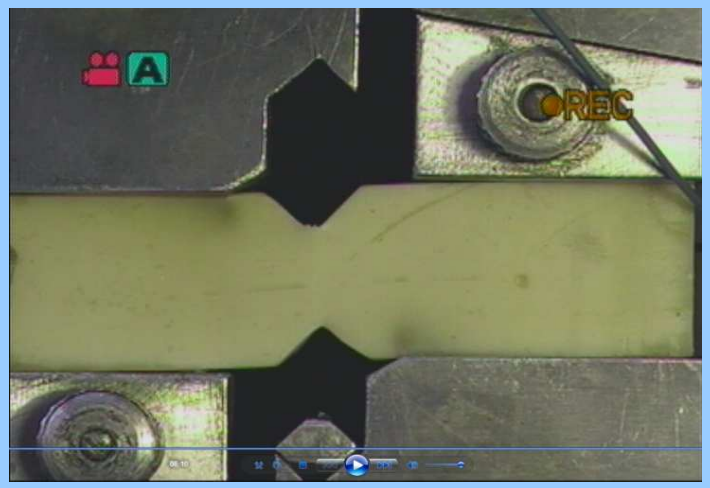
Hole-drilling strain gage method (ASTM Standard E837):

- the drilled hole is typically between 0.8 and 1.6 mm diameter and 1.2 times diameter depth (semi-destructive technique)
- X-Y adjusting screws
- alignment to within 0.038 mm of the gage center (using a special purpose microscope)
- incremental drilling (using micrometer depth set)
- high-speed air turbine
- tungsten carbide-tipped or diamond cutters



Iosipescu sample, shear and bending moment diagrams

Iosipescu shear test device (according to ASTM D 5379)



Sample mounted in the testing device

http://www.compositesworld.com/articles/a-comparison-of-shear-test-methods

Prof. *N. Iosipescu* have worked a period in our department