UNIVERSITY OF BANJALUKA
Faculty of Mechanical Engineering
Department of Production Engineering

Tempus Project University of Kragujevac
WBCVMnet
WBC Virtual Manufacturing Network
Fostering an Integration of the Knowledge Triangle

The brief presentation

Faculty, researchs, future researchs...

Assitant **Branislav Sredanović**, Univ. Dipl. Eng.

European Commission
TEMPUS

Univerza v Ljubljani
Fakulteta za strojništvo

LABOD®

CTC
Collaborative•Training•Centre
Banja Luka

SOME INFORMATION ABOUT ME...

Name and surname: Branislav Sredanović

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CONTENT

1. The city of Banja Luka
2. Faculty of Mechanical Engineering at University of Banjaluka
   a) University of Banjaluka
   b) Faculty of Mechanical Engineering
   c) Study programs
   d) Research and Laboratories on department
4. My research and knowledge
5. Expectation of visit and futhure cooperation

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THE CITY OF BANJA LUKA

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Banja Luka on map...

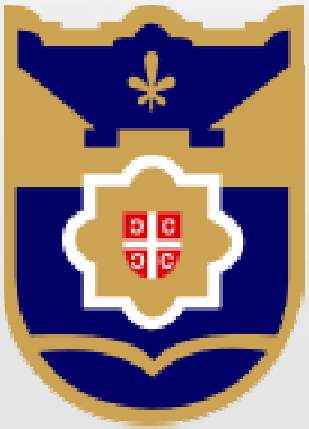
Distance from Banja Luka to Ljubljana is 360 km

THE CITY OF BANJA LUKA

- Capital of the Republic Srpska ,
- Area is 1239 square kilometers,
- Population is 250 000 (the second largest city in BiH).

Banja = ban‘s, govenor‘s

Luka = medow by the river



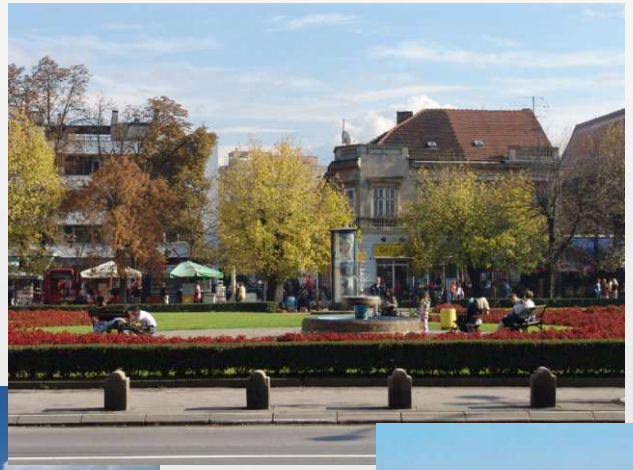
THE CITY OF BANJA LUKA

At first, under this name is metioned in 1494.

THE CITY OF BANJA LUKA

Banja Luka is named “green city”, with parks and alleys.

Banja Luka is built on the coast of Vrbas river.



THE CITY OF BANJA LUKA

Banja Luka is adminstrative and university center.

THE CITY OF BANJA LUKA

Also, Banja Luka is city of young people.

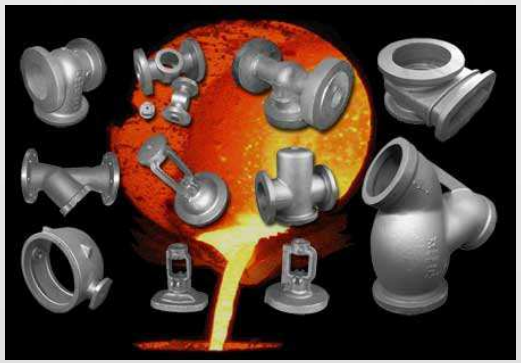
Some say that the ratio between women and men is 7:1

THE CITY OF BANJA LUKA

The economy of Banja Luka region is based on small and medium enterprises. Large companies were shut down during the civil war. Civil and process industries are dominant.

THE CITY OF BANJA LUKA

The most representative metal industry products in Banjaluka region.



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UNIVERSITY OF BANJALUKA

In Banja Luka, the university has two big camuses, and Faculty of Minning is located city of Prijedor.

- Founded in 1975.
- 16 Faculties and Academics
- 52 study programms
- 17 000 students
- 1000 academic and adminstration staff

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FACULTY OF MECHANICAL ENGINEERING

- Founded in 1971.
- 4 study programms
- 10 departmanes
- 14 laboratories
- 2 institutes
- 3 academic centres
- 600 students
- 50 academic staff

www.mfbl.rs.ba

FACULTY OF MECHANICAL ENGINEERING

95 % academic staff is domestic, and only 5 % are visiting profesors

- 6 full profesors,
- 7 associate profesors,
- 13 assistent profesors,
- 9 senior assisents,
- 5 assistents, etc.

FACULTY OF MECHANICAL ENGINEERING

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In last school year, buiding and laboratories of the facuty were renovated partialy. The faculty is equpped with adequate classroom, laboratories and computer classrooms.

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STUDY PROGRAMMS

Studies on the faculty are performed out in 5 study areas:

- Production engineering,
- Energetics and traffic engineering,
- Mehatronic,
- Industrial engineering and managment,
- Safety on work.

STUDY PROGRAMMS

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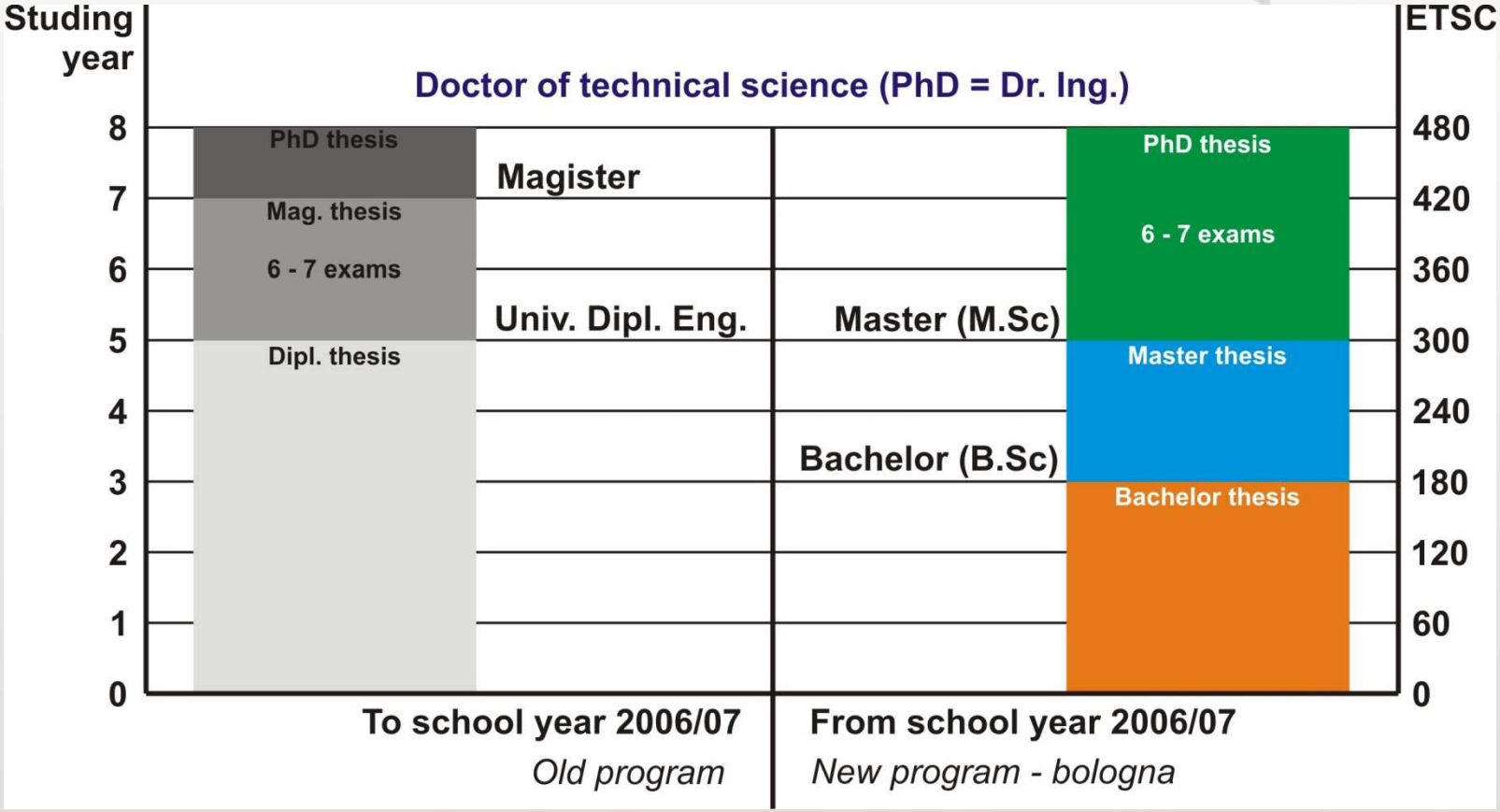
Studing system 3 + 2 year. Is it good?



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DEP. FOR CUTTING TECHNOLOGY AND MACHINING SYSTEMS

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Department for Cutting Tehnology and Machining Systems:

- 6 members (5 academic staff and 1 laborant),
- 2 laboratories.

Research areas:

- Technology of metal cutting,
- Tribology,
- Nonconventional technologies,
- Technology and production sys.,
- Design of machining centers,
- Flexibile machining systems,
- Tool and fixures design, etc,
- CAD/CAM/CAPP

DEP. FOR CUTTING TECHNOLOGY AND MACHINING SYSTEMS

Laboratories:

- Laboratory for Cutting Technologies and Machining System
- Laboratory for Computer Aided Process Planing

LABORATORY FOR COMPUTER AIDED PROCESS PLANING

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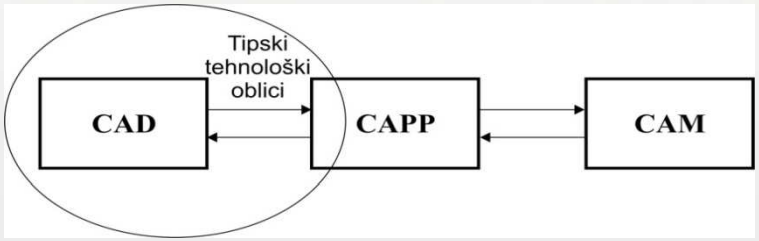
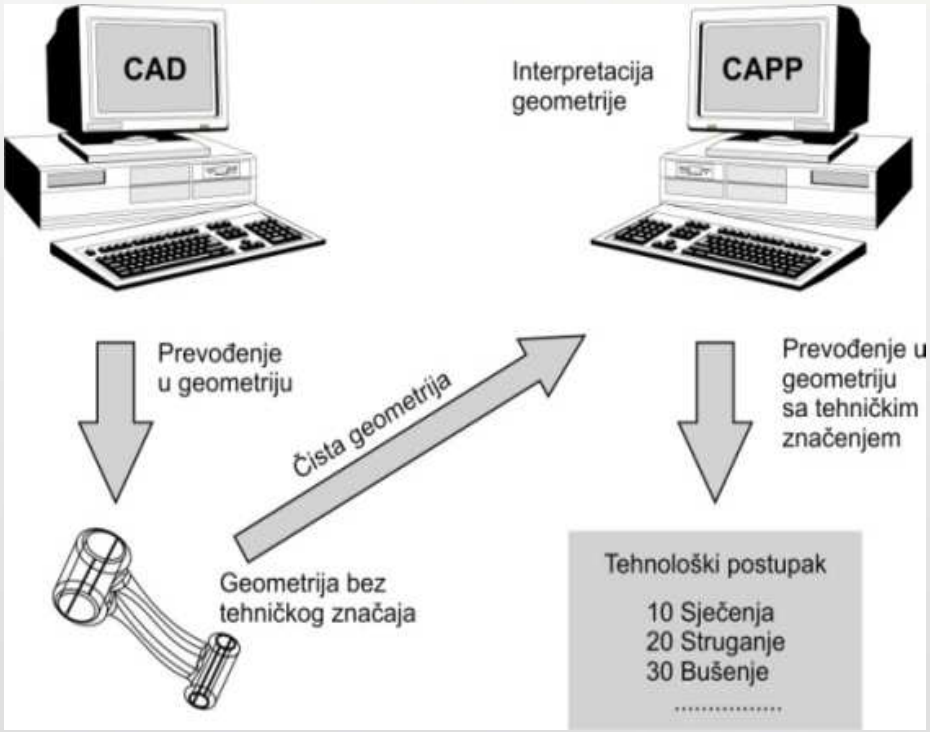
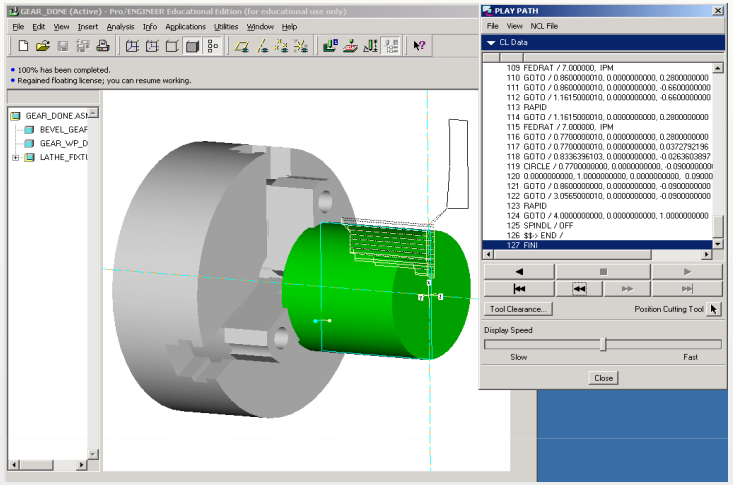
Activities in laboratory:

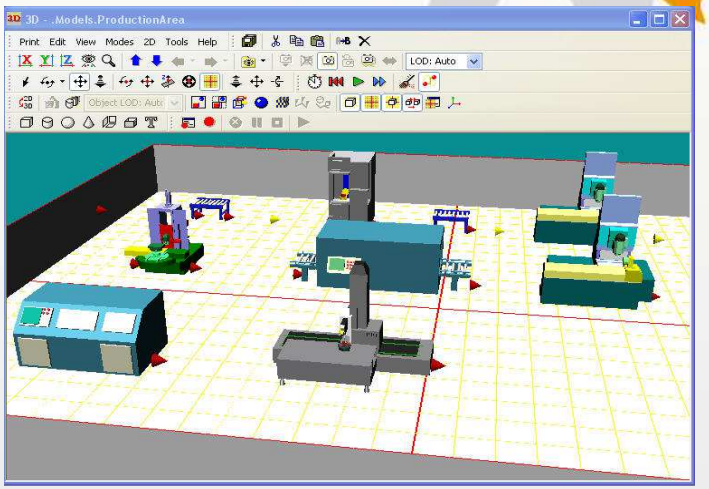
Development of systems for CAPP, modeling and optimization manufacturing systems, development of expert systems based on artifical inteligence.





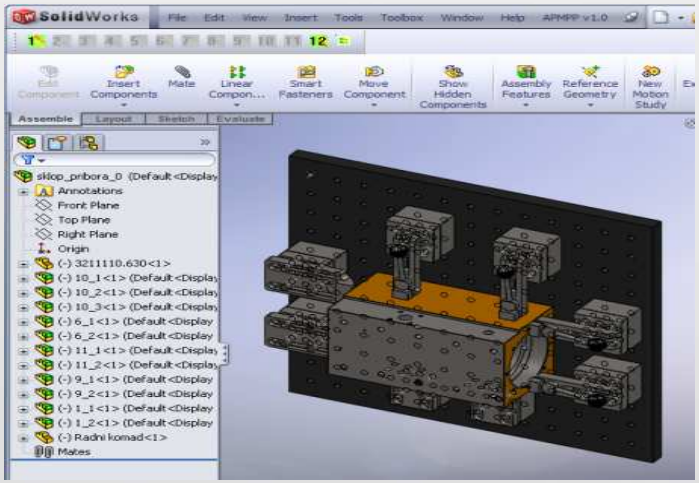
LABORATORY FOR COMPUTER AIDED PROCESS PLANING





Equipment:

- Personal computers,
- ProENGINEER and SolidWorks,
- Software Technomatix Plant Simulation,
- Software for planining of sheet bending PC 9000



LAB. FOR CUTTING TECHNOLOGY AND MACHINING SYSTEMS

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Main activities in laboratory:

- Investigation of metalcutting phenomenas,
- Investigation of material machinability,
- Modeling, simulating and optimisation in metalcutting tecnologies,
- Design machining systems for metalcutting,
- Research of statical and dinamical behaviour of machining systems,
- Design and optimisation of cutting tool,
- Design and optimisation of fixture tool,
- CNC programming and CAM modeling,
- Development of software systems for anayse in metalcutting technology.

Equipment:

System for measeure of cutting forces KISTLER

LAB. FOR CUTTING TECHNOLOGY AND MACHINING SYSTEMS

NC milling-boring machine WF 5/800 with Heidenhain control unit

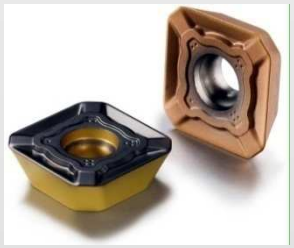
CNC educational turnning machine EMCO PC TURN 55, with Sinumeric control unit.

Universal conventional machines for metalcutting in laboratory...

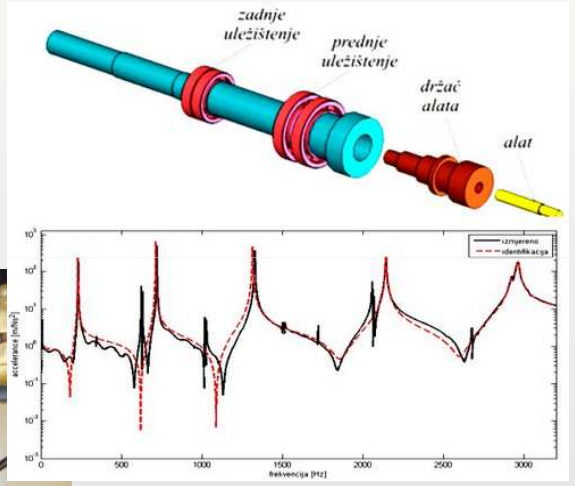




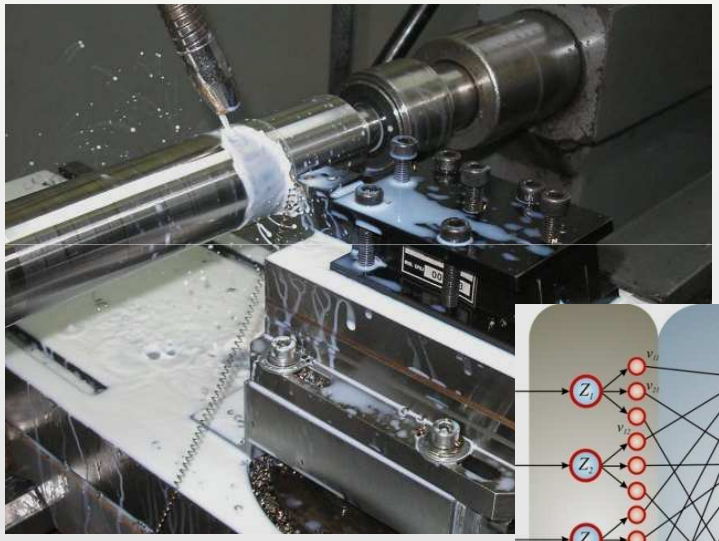

Project: Purchase of vertical machining centre EMCO MILL 450 with simulators

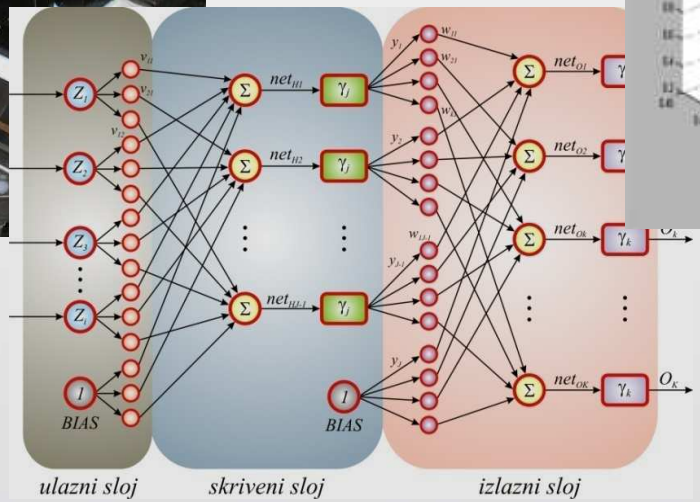


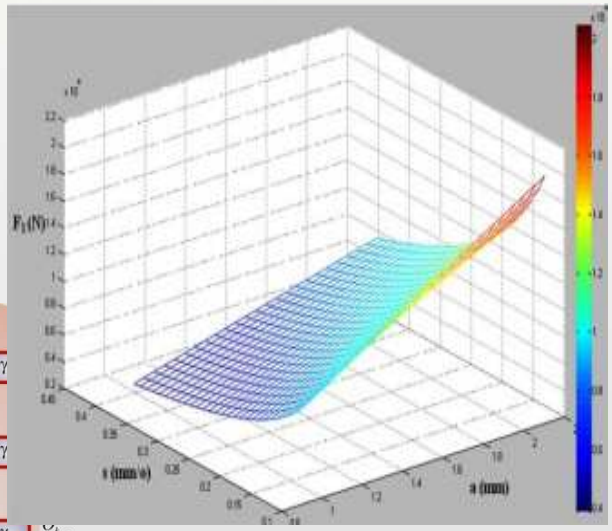
Project: Dynamic of metalcutting process and its interaction with structure of machining system



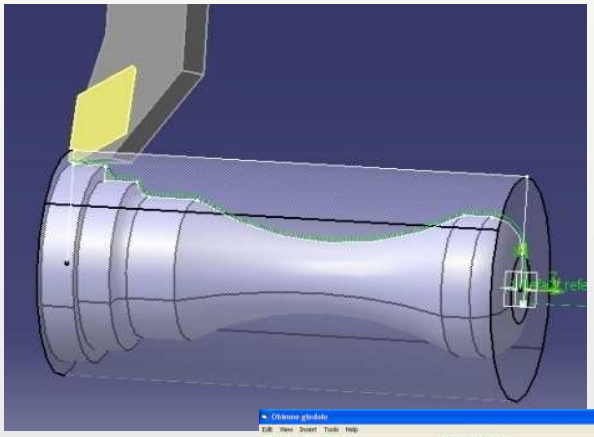
Project: Development and testing of models based on artifical neural network for monitoring of cutting process

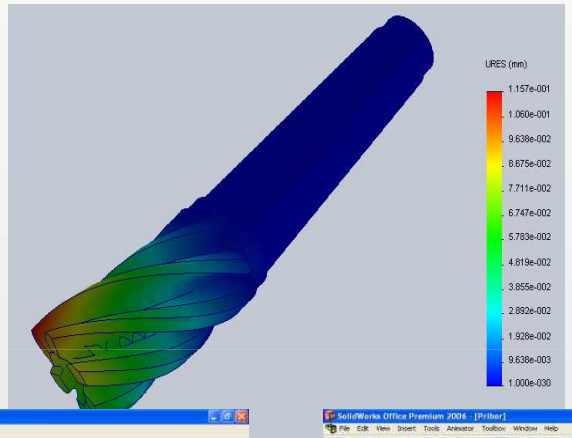


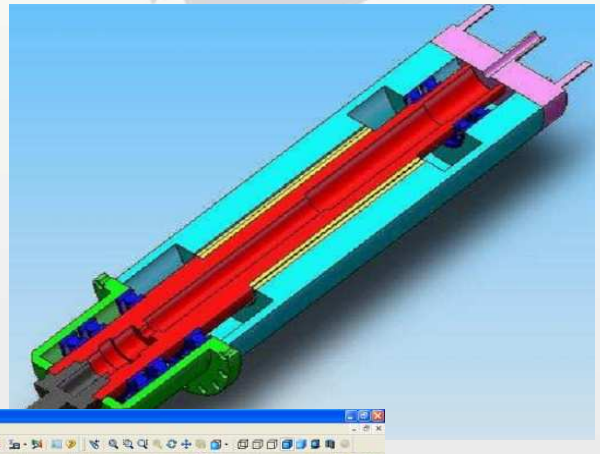


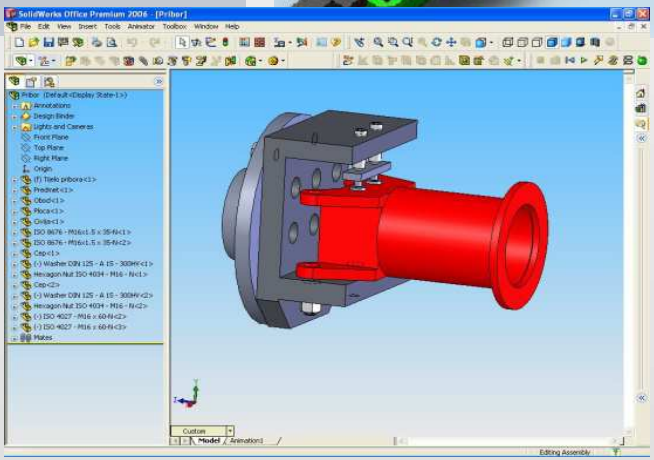


... Other daily activities...









... Other daily activities...

CONTENT

MY RESEARCH AND KNOWLEDGE

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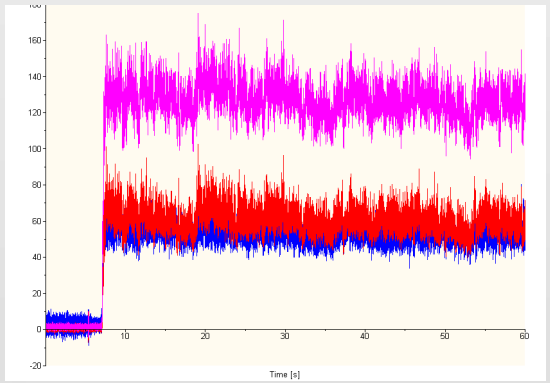
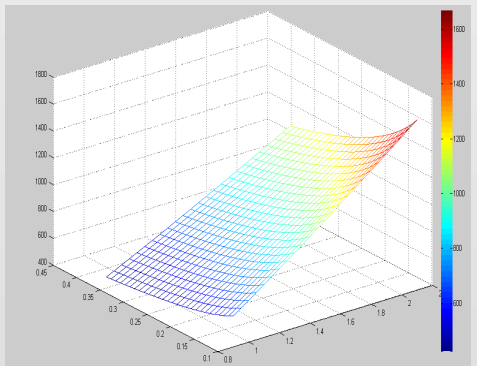
My basic researchs are in area of machinability of material and process modeling in cutting technologies.

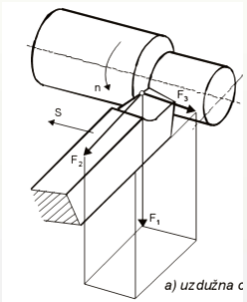
Because my job requires, other areas are:

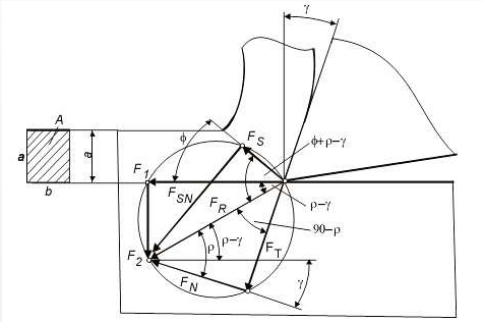
- Machining systems for metalcutting,
- Tool cutting and fixture systems,
- Nonconventional technologies,
- CAD/CAM/CAPP,
- Modeling with using FEM, AI, etc.,
- Softwares development and programming.



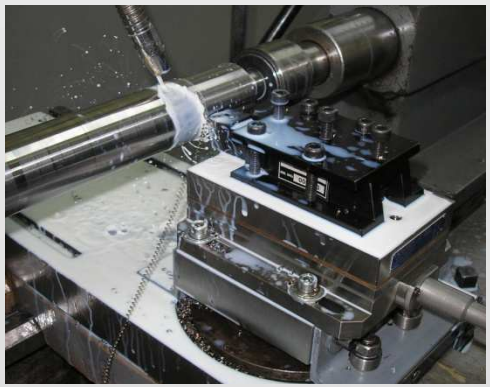


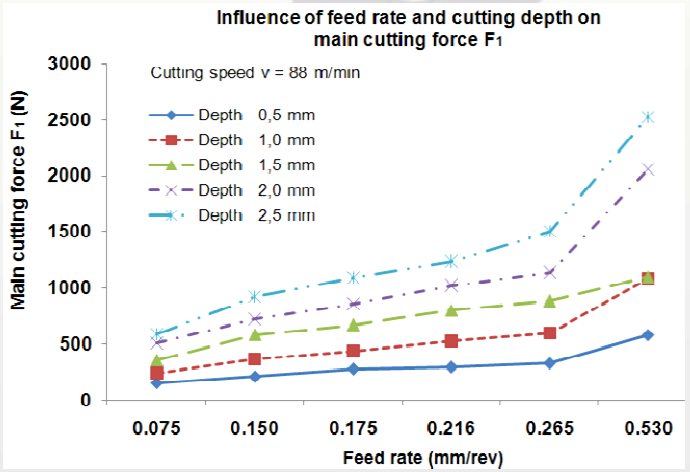
MY RESEARCH AND KNOWLEDGE

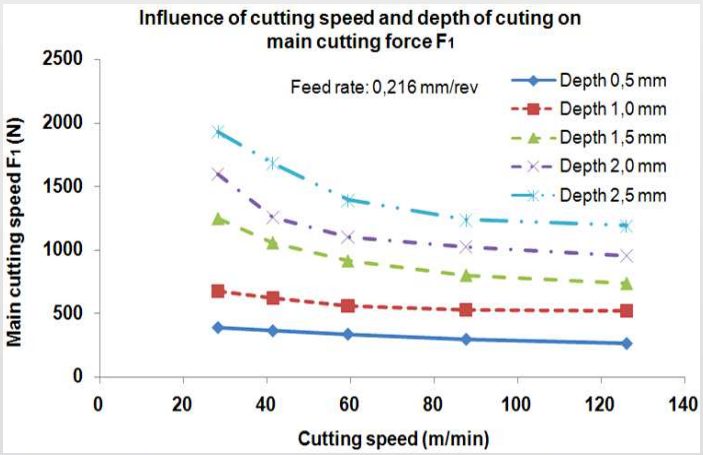




Knowledge based on studing of cutting processes, defining relation between parametrs and their depend on processes.







MY RESEARCH AND KNOWLEDGE

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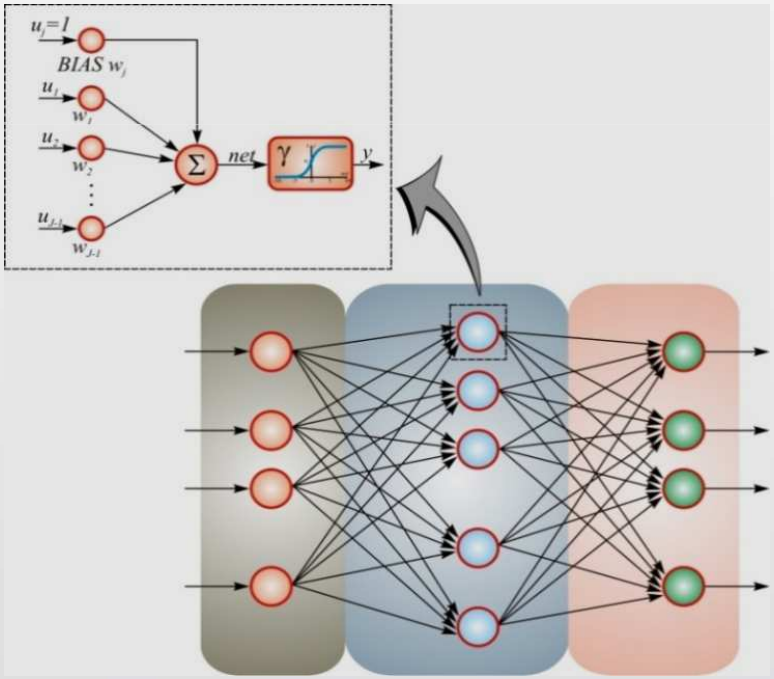
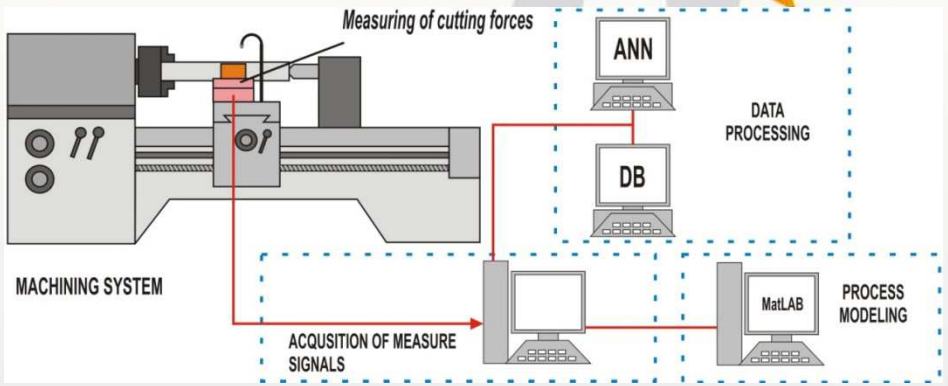
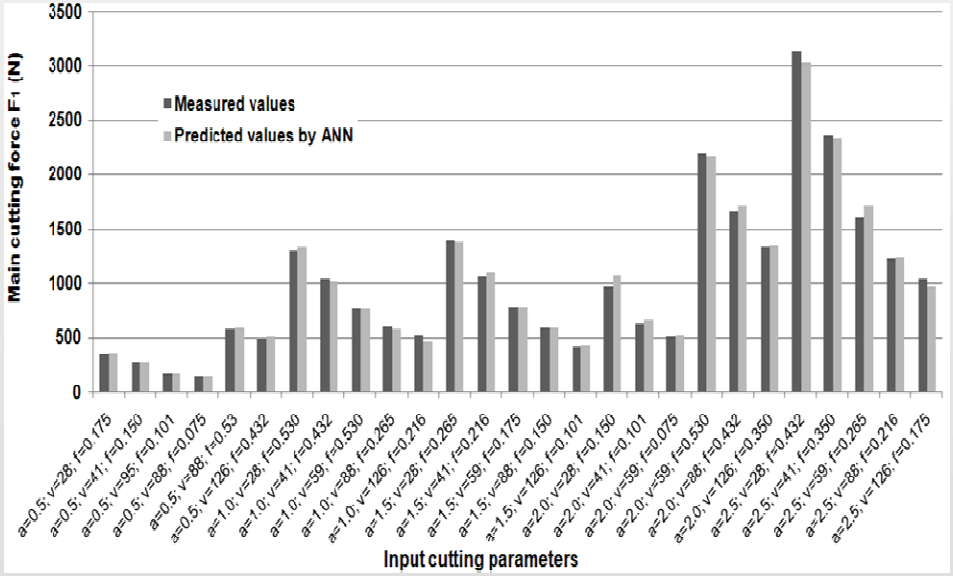
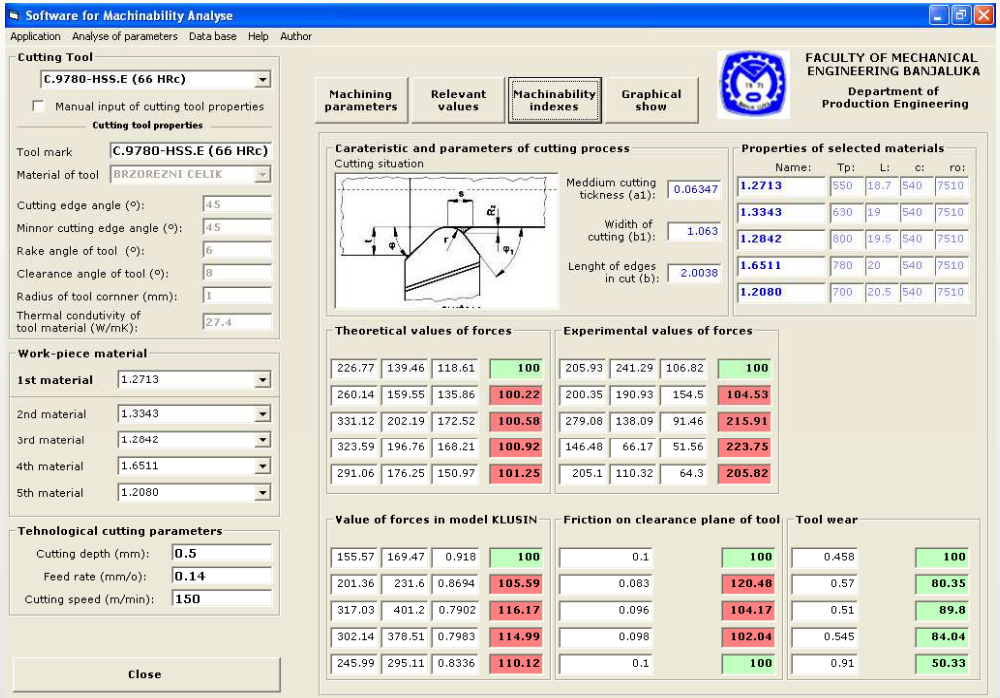
Artifical neural network can be successfully applied during modeling of cutting process.

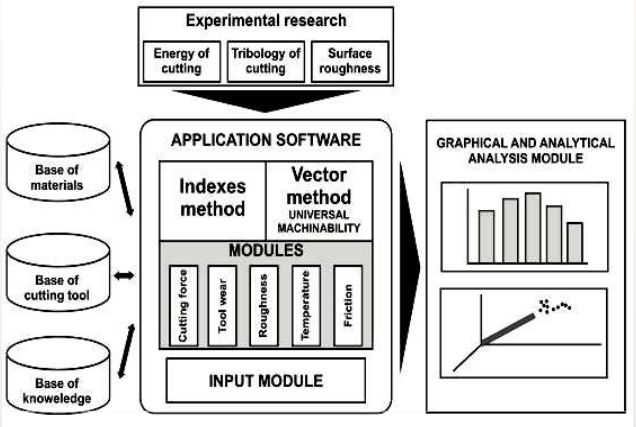






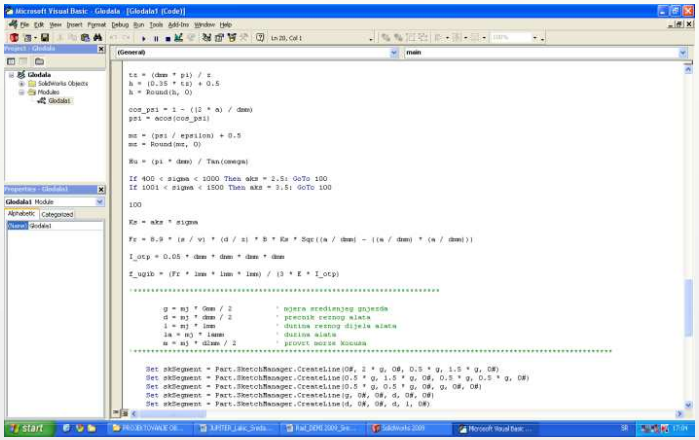
MY RESEARCH AND KNOWLEDGE



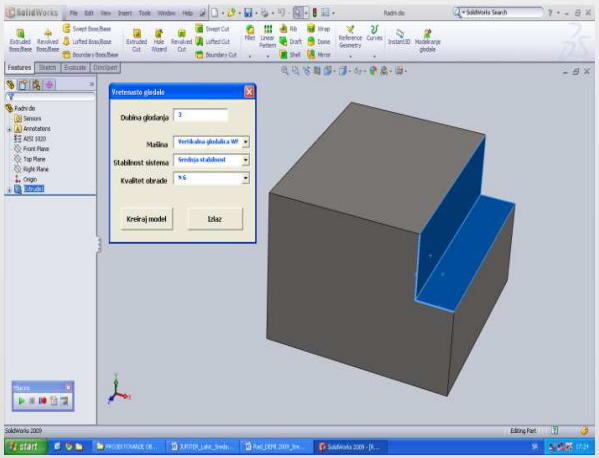


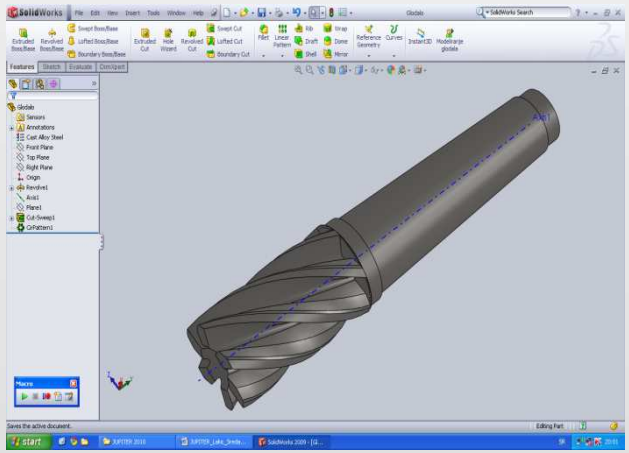
Knowledge in software development and programming (*Visual Basic*) is very good “weapon” in engineering.

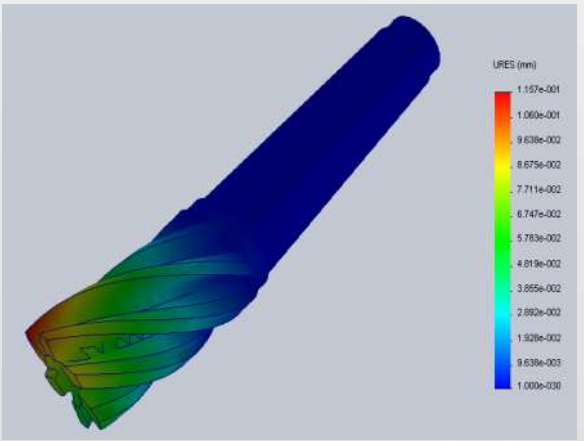
MY RESEARCH AND KNOWLEDGE



Knowledge in programming and knowledge in CAE (API) is very good combination to create usefull things for engineers...





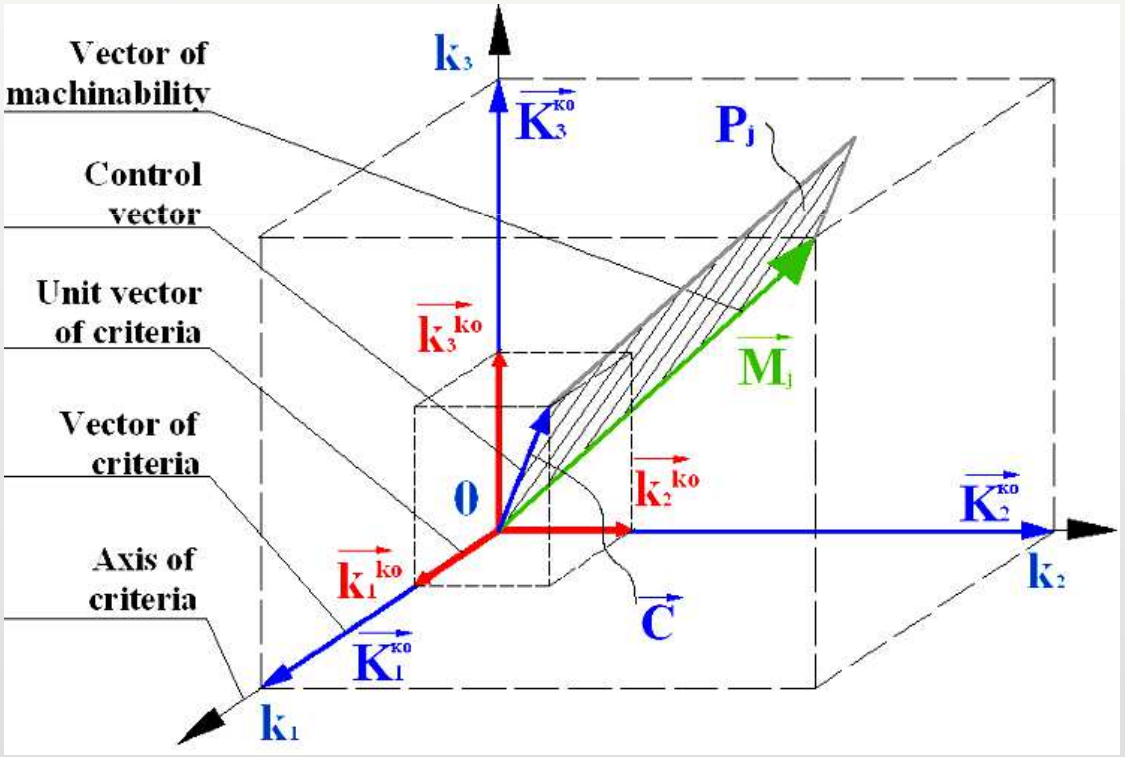


... UNIVERSAL MACHINABILITY

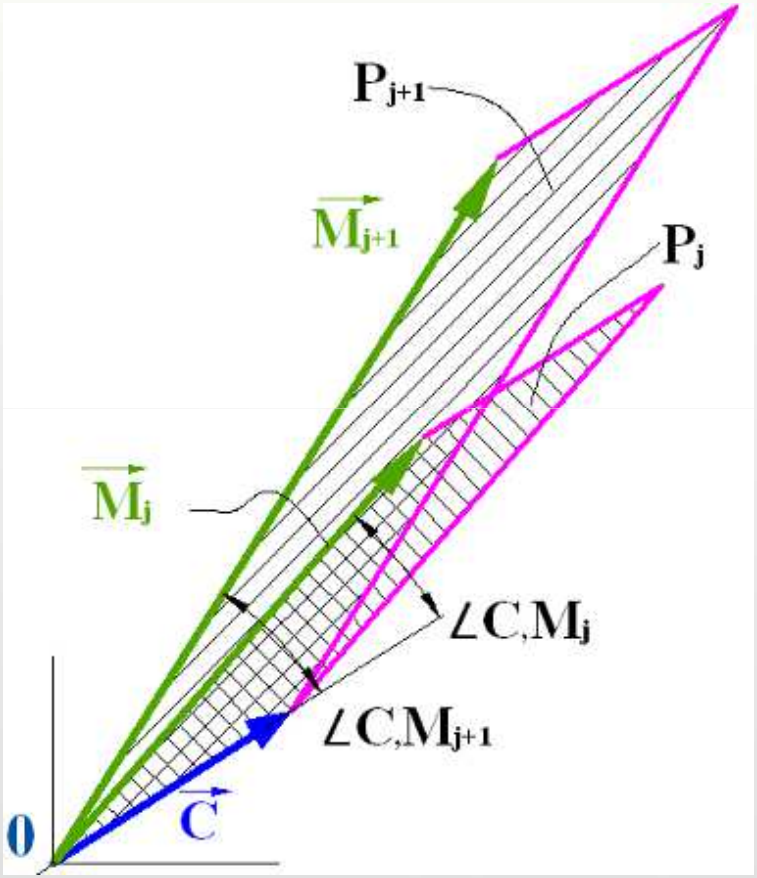
Curently, my attention are focused on exploring of universal machinability of materials.

Some material may have a good machinability according to one criteria, but very low machinability to the other criteria.

Universal machinability is based on the consideration of all criteria simultaneously.



MY RESEARCH AND KNOWLEDGE



$$\overrightarrow{M_j} = \sum_{i=1}^{n} \overrightarrow{K_i^{KO}}$$

Material with a small area defined by the parallelogram has better machinability compared to the material with a larger surface area of the parallelogram.

$$P_j = \left|\vec{C} \times \vec{M}_j\right| = \left|\vec{C}\right| \cdot \left|\vec{M}_j\right| \cdot \sin \angle\left(\vec{C}, \vec{M}_j\right)$$

Universal machinability (M_{univ}) is inversely proportional to the area of the parallelogram formed by machinability vector and control vector, and after mathematical operation, can be writen in final form:

$$M_{univ} = \left(\sqrt{F^2 + W^2 + R_a{}^2} \cdot \sqrt{1 - \frac{(F + W + R_a)^2}{\left(F^2 + W^2 + R_a{}^2\right)}} \right)^{-1}$$

where **F** (N) is result cutting force, **W** (mm/min) - tool wear intensity and **Ra** (μm) - surface roughness

Analysing of the previous formula, can be noticed the two parts. The first part of formula presents the influence of parameters on machinability. The second part of formula presents the influence of direct and mutual effects of certain parameters on machinability.

MY RESEARCH AND KNOWLEDGE

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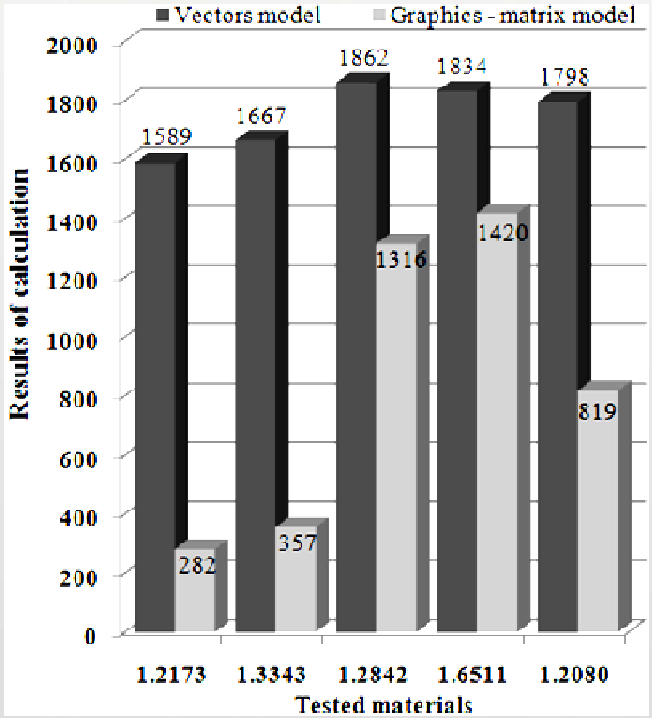
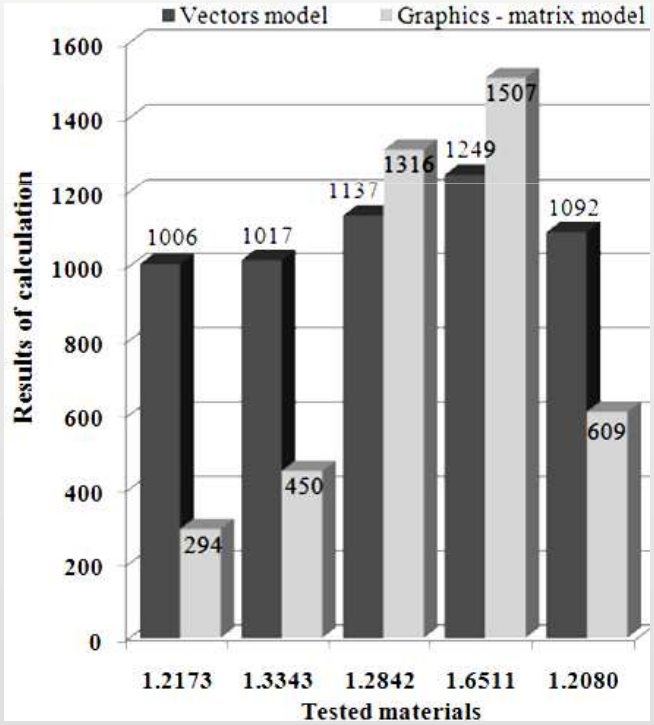
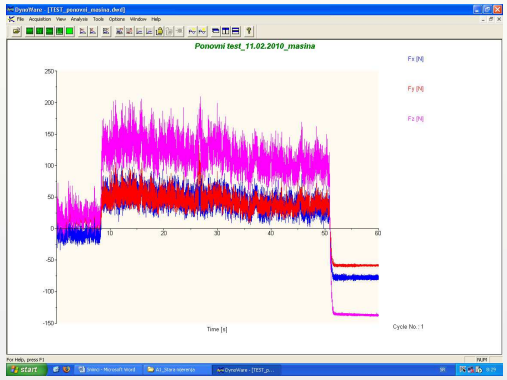
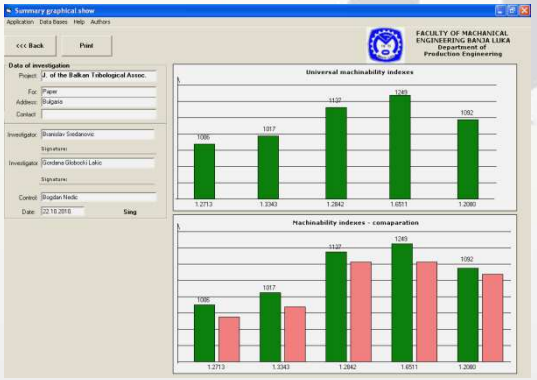
Vectors model of universal machinability gives good results in comparation with other model. Also, it has good sensitivity on input parameters.





MY RESEARCH AND KNOWLEDGE





$$F = f(\sigma_w,\ HB_w,\ a,\ f,\ v)$$

$$T = f(\sigma_w,\ \sigma_t,\ HB_t,\ HB_w,\ v,\ \mu,\ k_t)$$

$$R_a = f(r,\ \kappa,\ a,\ f,\ v,\ \mu)$$

Future research will focus on:

- Exploring the cutting processes (new materials, new tools, etc.),
- Establishment correlations between parameters in cutting process (depending on technological parameters),
- Analyse of machinability and analyse behavior of the vector machinability.
- Development of machinibility data base

MY RESEARCH AND KNOWLEDGE

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Plan of experimental setup in LABOD

Machine: **CNC turnning machine**
Tool: **SNMG 120408 NMX (*AC 3000*)**
Material: **100Cr6 (Bearing steel)**

Input parameters:

Type of process: 1) **Dry cutting** 2) **High pressure machining** 3) **MQL**

Technological parameters (variation in tree level):

1. Cutting depth $\mathbf{a_p}$ (mm)
2. Feed rate **f** (mm/rev)
3. Cutting speed $\mathbf{v_c}$ (m/min)

Output parameters:

1. **Cutting forces,**
2. **Surface roughness,**
3. **Tool wear**

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Results and analyse of experiment

Following can be done:

- Empirical equations of cutting forces, wich depends on input parameters, for different processes,
- Empirical equations of surface rougness, wich depends on input parameters, for different processes,
- Monitoring of tool wear for different processes,
- Analyse of individual machinability,
- Analyse of universal machinability,
- Some type of optimization (maybe??),
- Software for machinability analyise and monitoring.

LABOD®

CONTENT

1. The city of Banja Luka
2. Faculty of Mechanical Engineering at University of Banjaluka
   a) University of Banjaluka
   b) Faculty of Mechanical Engineering
   c) Study programs
   d) Research and Laboratories on department
4. My research and knowledge
5. Expectation of visit and futhure cooperation

EXPECTATION OF THE VISIT AND FUTHURE COOPERATION

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- Meet the very good friends and futhure cooperants,
- Make a good buisness connections,
- Get to know something about FS, Ljubljana and Slovenia,
- Introduce myself in european principles of work and research,
- Take some expirience in develop project with manufacturing companies,
- Take some expirience about new directions in metalcutting technologies,
- Meet equipment and problems in research of cutting processes,
- Make preparation for writing the paper,
- Leave a good impression on my Slovenian friends and cooperants.

THANKS FOR YOUR ATTENTION!

THANKS FOR YOUR NICE WELCOME!

I expect You on my Faculty...

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European Commission
TEMPUS

CTC
Collaborative • Training • Centre
Banja Luka