

HIGH TECHNICAL MECHANICAL SCHOOL OF TRSTENIK
INSTITUTE IMK "14. OCTOBER" OF KRUŠEVAC
INSTITUTE OF FACULTY OF MECHANICAL ENGINEERING
OF PODGORICA

3rd INTERNATIONAL CONFERENCE
RESEARCH AND DEVELOPMENT
IN MECHANICAL INDUSTRY
RaDMI 2003

CONFERENCE PROGRAMME
with Company presentation

19-23. September 2003.
Herceg Novi, Hotel "Plaža"
Serbia and Montenegro

ABOUT Conference RaDMI 2003

The First Conference "Situation and perspective of research and development in chemical and mechanical industry" - RaDMI 2001 was held upon the initiative of M.Sc. Predrag Dašić and Prof. Dr Miroslav Radovanović on the occasion of 40 years of teaching at High technological-technical school in Kruševac. The First Conference was held on 22-24. October, year 2001, in Kruševac, Republic Serbia. On the Conference are presented 118 papers from which 69 were from abroad, from 13 countries of the World. Number of author and coauthor was 206, from 15 countries of the World.

Multitude of papers and participants from abroad has influence on decision to organize Second Conference on international level. The Second International Conference "Research and development in mechanical industry" RaDMI 2002 was held on 01-04. September, year 2002, in Vrnjačka Banja, Republic Serbia. On the Conference are presented 258 papers from which 191 were from abroad, from 21 countries of the World. Number of author and coauthor was 385, from 25 countries of the World.

Third International Conference "Research and development in mechanical industry" RaDMI 2003 will hold on 19-22. September, year 2003, in Herceg Novi, Republic Montenegro.

Topics of the Conference RaDMI 2003 are:

- **Session A:** Research and development of manufacturing systems, tools and technologies, new materials and product design;
- **Session A:** Tribology;
- **Session C:** Maintenance and effectiveness of technical systems;
- **Session D:** Quality management, ISO 9000, ISO 14000, TQM and management in mechanical engineering;
- **Session E:** CA technologies (CAD; CAM; CAPP; CAE) and CIM;
- **Session F:** Application of information technologies in mechanical engineering;
- **Session G:** Application of mechanical engineering in other industrial fields.

The aim of organizing the Conference is: animating scientists from the faculty and from the institute and experts from the industry and their connecting and collaboration, and changing of the experiences and knowledge's domestic and foreign scientists and experts.

Third International Conference "Research and development in mechanical industry" - RaDMI 2003 hold by occasion of 80 years of Company "IMK 14. oktobar"-Kruševac. Sponsorship by the Ministry for science, technology and development of Republic Serbia and Ministry for education and science of Republic Montenegro is supportive of efforts to promote science and technology in the area of mechanical engineering in Serbia and Montenegro.

On behalf of the organizers, we would like to extend our thanks to all organizations and institutions that have supported the initiative to have this anniversary gathering organized. We would like to extend our thanks also to all authors and participants from abroad and from the country for contribution to this conference.

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FINAL PROGRAMME / FINALNI PROGRAM

19.09.2003. (Friday / petak)

12⁰⁰ - 20⁰⁰ Registration desk / Registracija učesnika (hotel Plaža)
20⁰⁰ - 24⁰⁰ Welcome cocktail / Koktel dobrodošlice (hotel Plaža)

20.09.2003. (Saturday / subota)

08⁰⁰ - 11⁰⁰ Registration desk / Registracija učesnika (hotel Plaža)
11⁰⁰ - 12⁰⁰ Opening conference / Otvaranje konferencije (congress hall)
12⁰⁰ - 14⁰⁰ Plenary session / Plenarna predavanja (congress hall)

- 1. Paro J. A., Gustafsson T. E., Koskinen J. (Espoo - Finland)**
CHIP MORPHOLOGY IN DRILLING OF CONVENTIONAL CAST
STAINLESS STEEL WITH HIPED NITI COATING
- 2. Kutin A., Strekalov A. (Moscow - Russia)**
APPLICATION OF INTEGRATED T-FLEX CAD/CAM AND NC-TRACER IN
PRODUCTION ENGINEERING
- 3. Petropoulos G., Pandazaras C. (Volos - Greece), Dašić P. (Kruševac -
Serbia and Montenegro)**
CHARACTERIZATION OF PROFILE SHAPES OF MACHINED SURFACES
- 4. Meissner K. (Jena - Germany)**
EVALUATION OF MEASURING PROCESSES
- 5. Burya A. I., Prikhod'ko O. G., Burmistr M. V. (Dnepropetrovsk -
Ukraine)**
KINETICS OF CHANGES OF AROMATIC POLYAMIDE PHENILON'S
FRICTION SURFACE
- 6. Palaghian L., Clortan S., Birsan I. (Galati - Romania)**
ABOUT THE DAMAGE AND FATIGUE LIFE OF SPUR GEAR USED IN
MACHINE TOOLS

14⁰⁰ - 14³⁰ Cocktail/Koktel

14³⁰ - 16⁰⁰ Pause for lunch / Pauza za ručak

16⁰⁰ - 20⁰⁰ Tourist excursion / Turistička tura

21.09.2003. (Sunday / nedelja)

08⁰⁰ - 10⁰⁰ Registration desk / Registracija učesnika (hotel Plaža)
10⁰⁰ - 12⁰⁰ Plenary session / Plenarna predavanja (congress hall)

- 7. Ruggiero A., Senatore A. (Fisciano - Italy)**
SOME RECENT ADVANCES ON THE MODELLING OF THE PISTON
ASSEMBLY DYNAMICS AND LUBRICATION
- 8. Kauppinen V., Paro J. (Espoo - Finland)**
HIGH-SPEED MILLING - A FEW EXAMPLES
- 9. Lubnauer W., Kazimierska-Grębosz M. (Łódź - Poland)**
DYNAMICS OF THE BOOM LOADED WITH A TIME-VARYING MASS
- 10. Slavov Z. (Varna - Bulgaria), Evans C. (Norwich - USA)**
ON A VECTOR OPTIMIZATION PROBLEM IN SYSTEMS ENGINEERING
- 11. Drăgulescu D., Toth-Taşcău M., Dreucsan M. (Timişoara - Romania)**
COMPARATIVE STUDY FOR PATH PLANNING OF A MOBILE MINI-ROBOT
- 12. Oprea F. (Lausanne - Switzerland), Laketić N., Gostović N. (Belgrade -
Serbia and Montenegro)**
TIME REDUCTION OF STANDSTILL OF EXCAVATOR ON THE INLAND
MINE IN THE MINING AREA "KOLUBARA"

- 12⁰⁰ - 13⁰⁰ Presentation of company and sponsors / Prezentacija firmi i sponzora (congress hall)
 13⁰⁰ - 14⁰⁰ Presentation of books and journals / Prezentacija knjiga i časopisa (congress hall)
 14⁰⁰ - 16⁰⁰ Pause for lunch / Pauza za ručak
 16⁰⁰ - 20⁰⁰ Tourist excursion / Turistička tura
 20⁰⁰ - 24⁰⁰ Conference Supper / Svečana večera

22.09.2003. (Monday / ponedjeljak)

- 09⁰⁰ - 12⁰⁰ Presentation of papers and round table discussion / Prezentacija radova i okrugli sto (congress hall)
 (Session A and B / Sekcija A i B)
 Chairman of session A / Predsedavajući za sekciju A:
 Pétropoulos Georgios (Volos - Greece), Kopac Janez (Ljubljana - Slovenia), Marinković Veljko (Niš - Serbia and Montenegro)
 Chairman of session B / Predsedavajući za sekciju B:
 Burmistr Mikhail (Dnipropetrovsk - Ukraine), Assenova Emilia (Sofia - Bulgaria), Radovanović Miroslav (Niš - Serbia and Montenegro)
 12⁰⁰ - 13⁰⁰ Presentation of company and sponsors / Prezentacija firmi i sponzora (congress hall)
 13⁰⁰ - 14⁰⁰ Presentation of books and journals / Prezentacija knjiga i časopisa (congress hall)
 14⁰⁰ - 16⁰⁰ Pause for lunch / Pauza za ručak
 16⁰⁰ - 19⁰⁰ Presentation of papers and round table discussion / Prezentacija radova i okrugli sto
 (Session C and D - congress hall)
 Chairman of session C / Predsedavajući za sekciju C:
 Jovičić Svetislav (Kragujevac - Serbia and Montenegro), Adamović Živostav (Zrenjanin - Serbia and Montenegro), Živković Dragan (Zrenjanin - Serbia and Montenegro)
 Chairman of session D / Predsedavajući za sekciju D:
 Tomášková Eva (Brno - Czech Republic), Kraljev Todor (Skopje - Republic of Macedonia), Nikolić Slavica (Novi Sad - Serbia and Montenegro)
 (Session E and F / Sekcija E i F - hall A)
 Chairman of session E / Predsedavajući za sekciju E:
 Toth - Tascu Mirela (Timisoara - Romania), Sladkowski Aleksander (Katowice - Poland), Velišek Karol (Bratislava - Slovakia)
 Chairman of session F / Predsedavajući za sekciju F:
 Sarı Burak (Ankara - Turkey), Karabegović Isak (Bihac - Bosnia and Herzegovina), Gordić Dušan (Kragujevac - Serbia and Montenegro)

23.09.2003. (Tuesday / utorak)

- 09⁰⁰ - 12⁰⁰ Presentation of papers and round table discussion / Prezentacija radova i okrugli sto (congress hall)
 (Session G / Sekcija G)
 Chairman of session A / Predsedavajući za sekciju A:
 Senatore Adolfo (Fisciano - Italy), Kegl Breda (Maribor - Slovenia), Zrnčić Nenad (Belgrade - Serbia and Montenegro)
 12⁰⁰ - 13⁰⁰ Close of the Conference / Zatvaranje konferencije (congress hall)

Papers for Session A: / Radovi za sekciju A:
RESEARCH AND DEVELOPMENT OF MANUFACTURING SYSTEMS, TOOLS AND TECHNOLOGIES, NEW MATERIALS AND PRODUCTION DESIGN

- A-1. Alexandru P., Antonya C., Andreica G. E. (Brasov - Romania)
 MECHANICAL TESTING OF THE LOCKING AND ADJUSTING MECHANISM OF THE CAR'S SEAT-BACK HINGE
 A-2. Andreescu B., Machedon-Pisu T., Olah A. (Brasov - Romania)
 NEW TECHNOLOGIES IN LASER THERMAL PROCESSINGS
 A-3. Andelić B. (Čačak, Serbia and Montenegro), Šijački-Zeravčić V., Baklić G., Đukić M. (Belgrade - Serbia and Montenegro)
 MICROSTRUCTURAL CHANGES OF W-MO-V TOOL STEEL DURING CONTINUOUS TEMPERING
 A-4. Anguelov N. P., Iliev P. L. (Sofia - Bulgaria), Simov S. S. (Rouse - Bulgaria)
 RESEARCH OF THE DAMPING CHARACTERISTICS OF ONE-TOOTH MILLING CUTTER WITH FREE PARTICLES IN ITS BODY
 A-5. Babić A., Miodragović G., Petrović A., Zukovski A. (Kraljevo - Serbia and Montenegro)
 THE DEVELOPMENT OF PROCESSES AND MILLING TOOLS IN MILLING ROAD PAVEMENTS
 A-6. Balashev I. (Gabrovo - Bulgaria)
 KINEMATIC STUDIES ON TWO- AND THREE-CARRIER DIFFERENTIAL PLANETARY MECHANISMS
 A-7. Balashev I., Jordanov A. (Gabrovo - Bulgaria)
 STUDY OF CHAIN ELECTRIC HOIST CONTAINING A PLANETARY TRANSMISSION WITH PERIODICALLY VARIABLE GEAR RATIO
 A-8. Barzev I. T., Parashkevov S. Z. (Gabrovo - Bulgaria)
 INFLUENCE OF LASER CUTTING ON RELATIVE VALUES OF TENSILE STRENGTH
 A-9. Başibüyük Y., Kılıç S. E., Anlağan Ö. (Ankara - Turkey)
 TOWARDS DISTRIBUTED MANUFACTURING: AN AGENT BASED CASE STUDY
 A-10. Bulea H. (Brasov - Romania)
 COMPARING STUDY: THE SURFACE RUGOSITY OF ISOSTATICAL PRESSED AND BIDIMENSIONALLY PRESSED OF SYNTERIZED ALUMINUM OXIDE CERAMIC (Al₂O₃)
 A-11. Cioară R. G. (Brasov - Romania)
 DIAMETRAL HYPOCYCLOIDAL AUTOMATIC MACHINE TOOLS FOR COLD FORMING. A SYNTHESIS OF TYPES AND CONSTRUCTIVE VARIANTS
 A-12. Cioară R. G., Cioară R. I. (Brasov - Romania)
 COMPACT DEVICE FOR SENSITIVE DELIVERY OF RODS. PREMISE AND SOME CONSTRUCTIVE VARIANTS
 A-13. Čučilović M. (Čačak - Serbia and Montenegro)
 DEVELOPMENT OF TWO-STAGE REVERSE PLANETARY MECHANISMS FOR PERIODICAL MOVEMENTS REALIZATION
 A-14. Dašić P. (Kruševac - Serbia and Montenegro)
 ANALYSIS CHOICE OF REGRESSION EQUATIONS IN FIELDS METALWORKING
 A-15. Deaconescu A., Deaconescu T. (Brasov - Romania)
 DEVICE FOR THE MAGNETO-ABRASIVE FINISHING OF ROLLER BEARING BALLS
 A-16. Dibner Yu. (Voronezh - Russia)
 THE FORECAST OF ALTITUDE ERROR OF CRANKSHAFT FORGINGS
 A-17. Dikov A., Stoev A., Dikov R. (Sofia - Bulgaria)
 ON THE MODELLING OF THE DIMENSION LINKS FOR MACHINING SYSTEMS AND PROCESSES
 A-18. Dinev G. (Sofia - Bulgaria)
 INVESTIGATION OF STEEL MECHANICAL CHARACTERISTICS IN GEARS OF TRACTIVE REDUCERS

- A-19. Dinkov P. (Sofia - Bulgaria)
MECHANICAL PROPERTIES OF THERMAL SPRAYED COATINGS WITH APPLICATION IN THE PLANT ENGINEERING
- A-20. Dobre G., Mirica R. F., Descallue M. (Bucharest - Romania)
POINTS OF VIEW ON PRODUCT LIFE CYCLE AND PRODUCT DEVELOPMENT
- A-21. Dolgij A. (Troyes - France), Guschinsky N., Levin G. (Minsk - Belarus)
GRAPH APPROACH FOR TRANSFER LINES BALANCING; EXACT AND HEURISTIC METHODS
- A-22. Drumeanu A. C., Nae I., Petrescu M. G. (Ploesti - Romania)
EXPERIMENTAL DETERMINATIONS CONCERNING THE DURABILITY OF THE MIDDLE ALLOY STEELS CYCLIC NON-ISOTHERMAL STRESSED
- A-23. Dyomin Y. N. (Moscow - Russia)
PLANT AND TECHNOLOGY FOR ELECTRIC-DISCHARGE ALLOYING STEELS
- A-24. Hristov H. G., Todarov R. P. (Gabrovo - Bulgaria)
GABBOVITE FORMATIONS OF SECONDARY CEMENTITE
- A-25. Hristov H. I., Ivanov I. R., Nedelcheva P. M. (Gabrovo - Bulgaria)
DETERMINING THE GEOMETRY OF TAPER REAMERS WITH SEMI-CIRCULAR CROSS-SECTION
- A-26. Iancic S., Popovici G. (Rasija - Romania)
CONTRIBUTIONS TO DESIGN OF A NEW CYCLOIDAL SWING LINK SPEED REDUCER
- A-27. Ioan S. (Brasov - Romania)
ELASTIC AND SAFETY CLUTCH WITH FOLLOWERS WITH THE ESTABLISH OF THE TORSION MOMENT AND OF THE ELASTIC CHARACTERISTIC
- A-28. Jovanic D., Rančić M., Lazić Lj. (Zrenjanin - Serbia and Montenegro)
EXPERIMENTAL DETERMINATION OF THE DUCTILITY OF THE JOINT WELDED BY MAG WELDING PROCESS
- A-29. Jovanović S., Pavlović N. D. (Niš - Serbia and Montenegro)
NEW DESIGN OF THE MECHANICAL SYSTEM OF GONIOPHOTOMETER
- A-30. Karabegović I. (Bihac - Bosnia and Herzegovina), Jurković M. (Rijeka - Croatia), Mahmić M. (Bihac - Bosnia and Herzegovina)
THE EXPERIMENTAL EXAMINATION OF MATERIAL PROCESSING MEASURING TOOL EXISTING
- A-31. Karabegović I. (Bihac - Bosnia and Herzegovina), Jurković M. (Rijeka - Croatia), Rošić H. (Bihac - Bosnia and Herzegovina)
A EXPERIMENTAL RESEARCHING AND MODELLING OF TOOL EXISTING AT THE BORING PROCESS
- A-32. Kazimierska-Grębosz M., Lubnauer W. (Łódź - Poland)
POSSIBILITIES OF REDUCTION OF THE NOISE EMITTED BY ENGINEERING MACHINES OPERATING IN AN OPEN SPACE
- A-33. Klein V. M. (Brasov - Romania)
ASPECTS REGARDING APPLICATION AREAS OF POLYCRYSTALLINE DIAMOND CUTTING TOOLS
- A-34. Klein V. M. (Brasov - Romania)
THE MATERIALS SELECTION, A COMPLEX PROCESS
- A-35. Kopac J., Sokovic M., Dolinsek S. (Ljubljana - Slovenia)
HIGH SPEED MACHINING AS INTERESTING PROCESS BY RAPID TOOLING
- A-36. Kostadinov V. S. (Rousse - Bulgaria)
COMBINED INSTRUMENT FOR PROCESSING OF HOLES BY WAY OF SURFACE PLASTIC DEFORMING (SPD)
- A-37. Kostadinov V. S. (Rousse - Bulgaria)
REGULARITIES IN DIMENSION FORMATION IN COMBINED PROCESSING THROUGH PLASTIC SURFACE DEFORMATION
- A-38. Kuzin V. M. (Moscow - Russia), Dašić P. (Kruševac - Serbia and Montenegro)
PROSPECTS OF COATED CERAMIC CUTTING TOOLS USE
- A-39. Kuzin V. V., Fodorov S. Yu. (Moscow - Russia)
WORKING CAPABILITY AND RELIABILITY OF TOOLS FROM NITRIDE'S CERAMIC BY WORK OF HARD STEEL
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- A-88. Ștefan M., Sorin I. (Oradea - Romania)
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- A-93. Udrolu R. (Brasov - Romania)
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- A-95. Ungur P., Pop M. T., Maghlar T., Lucaclu I., Moga I. (Oradea - Romania)
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- A-96. Vodolazskaya E., Iskrizkiy V. (Kramatorsk - Ukraine), Vodolazskaya N. (Donetsk - Ukraine)
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- A-97. Vodolazskaya N. (Donetsk - Ukraine)
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- A-98. Wasilkowska A. (München - Germany), Huckert D. (Lyon - France), Pichter A., Traint S. (Linz - Austria), E. Werner (München - Germany)
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- A-99. Zaimović-Uzunović N., Čurić D., Mulabdić J., Hadžihmetović A., Lemeš S. (Zenica - Bosnia and Herzegovina)
APPLICATION OF RAPID PROTOTYPING IN PROCESS OF MAKING TOOLS FOR METAL CASTING
- A-100. Zhachkin S. Y., Smolentsev V. P. (Voronezh - Russia)
QUALITY IMPROVEMENT OF PARTS RESTORED BY GALVANIC CONTACT PLATING (GCP)
- A-101. Zhelezarova D. L., Angelov I. A. (Gabrovo - Bulgaria)
FATIGUE TESTING OF SMOOTH SPECIMENS MADE OF 22G2SAF STEEL AND DETERMINING THE CRITICAL CRACKING RESISTANCE IMPACT ON LIMITED LIFE
- A-102. Živković M. (Trstenik - Serbia and Montenegro)
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**Papers for Session B: / Radovi za sekciju B:
TRIBOLOGY**

- B-1. Aydeenko A. P. (Kramatorsk - Ukraine)
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- B-2. Bibire L., Cobrea C. (Bacau - Romania)
USING OF AMERICAN DESIGN STANDARDS FOR OIL STORAGE TANKS, Part I
- B-3. Bibire L., Cobrea C. (Bacau - Romania)
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- B-4. Bumbalek B., Bumbalek L. (Brno - Czech Republic)
TRIBOLOGICAL PROPERTIES OF CERAMIC MATERIALS COATED BY THERMAL
SPRAYING
- B-5. Burya A. I., Chigvintseva O. P., Burmistr M. V. (Dnipropropetrovsk - Ukraine)
BASIC TECHNIQUES OF POLYARYLATE'S SYNTHESIS
- B-6. Burya A. I., Darkach O. D., Burmistr M. V. (Dnipropropetrovsk - Ukraine)
EFFECT OF COUNTERFACE ROUGHNESS ON FRICTION AND WEAR OF CARBON
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- B-7. Burya A. I. (Dnipropropetrovsk - Ukraine), Kozlov G. V., Novikov V. U., Ivanova V. S.
(Moscow - Russia)
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- B-8. Butnarlu S., Jula A. (Brasov - Romania)
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- B-9. Cârăbag I. (Timișoara - Romania)
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- B-10. Dašić P. (Kruševac - Serbia and Montenegro), Franek F. (Vienna - Austria),
Petropoulos G. (Volos - Greece)
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- B-11. Deljanin D., Manojlović S. (Kruševac - Serbia and Montenegro)
NEW LUBRICANTS FOR LUBRICATION OF OPENED TRANSMISSION GEARS
- B-12. Dikova T. (Varna - Bulgaria)
MACRO AND MICROSTRUCTURE OF DIE STEELS 3CH2W6F (H21) AND 5CHNM (L6)
AFTER LASER TREATMENT AND THERMAL CYCLING
- B-13. Drobnjak R. (Užice - Serbia and Montenegro), Milosavljević A., Drobnjak P., Pocuca E.
(Belgrade - Serbia and Montenegro), Kutić M. (Smederevska Palanka - Serbia and
Montenegro)
DETERMINING OPTIMAL PARAMETERS OF ELECTRO RESISTANCE SPOT WELDING
VARIOUS CHEMICAL COMPOSITION STEELS
- B-14. Drumeanu A. C., Antonescu N. N., Nae I., Petrescu M. G. (Ploiesti - Romania)
TRIBO-THERMAL FATIGUE WEAR AND THE DESIGN CALCULUS OF THE DRY
FRICTION COUPLE METALLIC ELEMENTS
- B-15. Duju L. M. (Brasov - Romania)
CONSTRUCTIVE TYPES OF INTERMITTENT MECHANICAL CLUTCHES WITH
FRICTION
- B-16. Fernengel V., Popa A. (Timisoara - Romania)
STUDY OF THE TRIBOLOGICAL BEHAVIOR OF MECHANICAL FACE SEALS
- B-17. Gavrilă L., Gavrilă D. (Bacău - Romania)
CORROSION OF METALLIC MATERIALS IN COOLING WATER SYSTEMS OF
CHEMICAL, PETROCHEMICAL AND POWER PLANTS
- B-18. Gavrilă L., Gavrilă D. (Bacău - Romania)
FAILURE OF STAINLESS STEEL HEAT EXCHANGERS IN SULFUR RECOVERY UNITS
FROM OIL REFINERIES
- B-19. Georgiev D. S., Krastev K. A. (Varna - Bulgaria)
TECHNOLOGICAL POSSIBILITIES OF VIBRATORY BURNISHING FOR IMPROVEMENT
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- B-20. Georgiev D. S., Slavov S. D. (Varna - Bulgaria)
INVESTIGATION FOR INFLUENCE OF QUALITY PARAMETERS OF FLAT STEEL
SURFACES WHICH HAVE A REGULAR CHEAP OF ROUGHNESS OBTAINED BY USING
A FLAT VIBRATORY BURNISHING TO THEIRS TRIBOLOGY CHARACTERISTICS
- B-21. Irimescu L., Diaconescu E. (Suceava - Romania), Berthier Y. (Lyon - France)
EXPERIMENTAL INVESTIGATIONS ON INTERFACE PHENOMENON IN A FRETTING
CONTACT
- B-22. Javorova J. G. (Sofia - Bulgaria)
BASIC BEARING CHARACTERISTICS OF HD JOURNAL BEARING IN THE CONDITIONS
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- B-23. Javorova J. G., Alexandrov V. A., Stanulov K. G. (Sofia - Bulgaria)
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- B-24. Jegdlić B. (Belgrade - Serbia and Montenegro), Radenković G. (Niš - Serbia and
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- B-25. Kandova M., Assenova E. (Sofia - Bulgaria)
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- B-26. Lukovics I. (Zlín - Czech Republic)
TRIBOLOGICAL CHARACTERISTICS IN POLYMERS AND METALS APPLICATION
- B-27. Marković G. (Pitov - Serbia and Montenegro), Radovanović B. (Niš - Serbia and
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Cincović M., Babić D. (Belgrade - Serbia and Montenegro)
SYNTHESIS AND SHARACTERIZATION OF CR/CSM/SiO₂ NANOCOMPOSITES
- B-28. Marković S. (Čačak - Serbia and Montenegro), Josifović D., Neđić B. (Kragujevac -
Serbia and Montenegro), Čirić R. (Čačak - Serbia and Montenegro)
TOOTH GEAR WELDING METHODS TO BE SELECTED ON THE BASIS OF
TRIBOLOGICAL STUDIES
- B-29. Muscalu E., Titu M. (Sibiu - Romania)
EXPERIMENTAL STUDIES ON THE ELECTRIC EROSION PROCESSING OF SINTERED
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- B-30. Oláh A. (Brasov - Romania)
RESEARCH REGARDING THE INFLUENCE OF LASER BEAM HARDENING UPON
NITROCARBURATE COATINGS
- B-31. Pehan S., Kegl B. (Maribor - Slovenia)
FRICTION MEASUREMENT ON SMALL INTERNAL COMBUSTION ENGINE
- B-32. Popa A., Fernengel V. (Timișoara - Romania)
ELECTROTRIBOLOGICAL ANALIZE OF THE TENSION DROP AND THE RESISTANCE
INFLUENCING FACTORS ON SLIDING ELECTRIC CONTACTS
- B-33. Popa N., Enescu M. (Pitești - Romania)
EXPERIMENTAL RESEARCH REGARDING THE TRIBOLOGIC PROCESSES FOR THE
MECHANICAL FACE SEALS
- B-34. Popescu M. (Timișoara - Romania)
PECULIARITIES ON THE CORROSION BEHAVIOUR OF WELDED JOINTS MADE OF MG
ALLOY MATRIX COMPOSITES BY GMA WELDING
- B-35. Rakić R. (Novi Sad - Serbia and Montenegro)
TRIBOLOGICAL ASPECTS OF THE CHOICE OF METALWORKING FLUID IN TURNING
PROCESS
- B-36. Sroka Z. (Wroclaw - Poland)
TRIBOLOGICAL SYSTEMS IN COMBUSTION ENGINE
- B-37. Titu M., Muscalu E. (Sibiu - Romania)
THEORETICAL AND EXPERIMENTAL ASPECTS REGARDING THE WEAR OF THE
TRANSFER OBJECT IN THE ELECTRIC EROSION PROCESSING
- B-38. Trujić P. (Novi Sad - Serbia and Montenegro)
A SHORT STORY ON SYNTHETIC OILS

**Papers for Session C: / Radovi za sekciju C:
MAINTENANCE AND EFFECTIVENESS OF TECHNICAL
SYSTEMS**

- C-1. Adamović Ž., Petrović Lj. (Zrenjanin - Serbia and Montenegro)
ACTUAL APPROACHES TO THE SYSTEM MAINTENANCE
- C-2. Adamović Ž., Petrović Lj. (Zrenjanin - Serbia and Montenegro)
EFFECTIVE SYSTEMS FOR VIBRATION ANALYSIS AND PREDICTIVE MAINTENANCE APPLICATIONS
- C-3. Čatić D., Jovičić S. (Kragujevac - Serbia and Montenegro)
FAULT TREE ANALYSIS OF THE LIGHT INDUSTRIAL VEHICLE STEERING SYSTEM
- C-4. Dašić P., Veselinović S., Marić A. (Kruševac - Serbia and Montenegro)
ANALYSIS OF THE EXPONENTIAL MODELS FOR THE RELIABILITY OF POWER SYSTEM FOR ECCENTRIC PRESS INN 1500
- C-5. David S., Toader S. (Reșița - Romania)
STRATEGY OF S.C. U.C.M. REȘIȚA S.A. CONCERNING MAINTENANCE OF MANUFACTURED HYDRO-ELECTRICAL EQUIPMENT
- C-6. Džhanakmedov A. Kh., Aliyev A. M., Janshmadov E. A. (Baku - Azerbaijan)
MAINTENANCE OF TIGHTNESS OF CONIC VALVES OF X-MAS TREES
- C-7. Ghița E., Tucu D. (Timișoara - Romania)
THE STATE OF RESIDUAL STRESSES AND CRACKS IN RAILROADS-A CRITERION FOR THE MAINTENANCE INSPECTION
- C-8. Grujić N. (Požarevac - Serbia and Montenegro), Soldat D. (Zrenjanin - Serbia and Montenegro)
DETERMINATION OF RELIABILITY OF ENGINEERING SYSTEMS
- C-9. Ivanović N. (Belgrade - Serbia and Montenegro), Ivanović P., Pantić R., Mijatović M. (Trstenik - Serbia and Montenegro)
NEW ACCESS OF MAINTENANCE OPTIMAL SELECTION STRATEGY OF HYDRAULIC SYSTEMS BY ASPECT OF EFFECTIVENESS AND RELIABILITY
- C-10. Marić A., Đurić S. (Kruševac - Serbia and Montenegro)
THE ANALYSIS OF CONSTRUCTION THE EFFICIENCY OF MAINTENANCE DURING THE EXPLOATATION
- C-11. Nikolić D. (Vrańje - Serbia and Montenegro), Adamović Ž. (Zrenjanin - Serbia and Montenegro), Stefanović S. (Niš - Serbia and Montenegro), Jevremović V. (Trstenik - Serbia and Montenegro)
THE EXAMINATION OF THE HYDRAULIC DRIVE OF THE ROTATING TABLE BY MEANS OF A MATHEMATICAL MODEL
- C-12. Petrović Lj. Z. (Zrenjanin - Serbia and Montenegro)
COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEMS (CMMS) AND EFFECTIVE MAINTENANCE
- C-13. Petrović Lj. Z. (Zrenjanin - Serbia and Montenegro), Radovanović S. V. (Novi Sad - Serbia and Montenegro)
THE MAINTENANCE STRATEGIES OF AGRICULTURAL MACHINES
- C-14. Soldat D. (Zrenjanin - Serbia and Montenegro), Grujić N. (Požarevac - Serbia and Montenegro)
THE STRATEGY OF MAINTENANCE OF INDUSTRIAL OBJECTS
- C-15. Šimon A. E., Moraru C. O., Iovănaș M. D. (Brasov - Romania)
ANALYSES OF THE CORRELATION BETWEEN CAPABILITY AND RELIABILITY OF THE TECHNOLOGICAL PROCESS
- C-16. Stefanović S. (Niš - Serbia and Montenegro), Rančić M. (Zrenjanin - Serbia and Montenegro), Jevremović V. (Trstenik - Serbia and Montenegro)
DIAGNOSTIC PARAMETERS IN MAINTAINING OIL-HYDRAULIC PUMPS AND MOTORS
- C-17. Tanasijević S., Jovičić S. (Kragujevac - Serbia and Montenegro), Čirić-Kostić S. (Kraljevo - Serbia and Montenegro), Marković S. (Čačak - Serbia and Montenegro)
IMPLEMENTATION NECESSITY OF DAMAGED MACHINE ELEMENTS REGENERATION

- C-18. Živković D. (Zrenjanin - Serbia and Montenegro), Veljić M. (Belgrade - Serbia and Montenegro)
A SYSTEM OF QUALITATIVE MAINTENANCE OF PLOUGHS AND SOWING MACHINES
- C-19. Živković D. (Zrenjanin - Serbia and Montenegro), Veljić A. (Čačak - Serbia and Montenegro)
EFFECTS OF IMPLEMENTING AN INFORMATION SYSTEM IN MAINTENANCE OF MANUFACTURING EQUIPMENT AT A COMBINE FACTORY

**Papers for Session D: / Radovi za sekciju D:
QUALITY MANAGEMENT, ISO 9000, ISO 14000, TQM AND
MANAGEMENT IN MECHANICAL ENGINEERING**

- D-1. Banović A., Stefanović D. (Novi Sad - Serbia and Montenegro)
DEFINING OF THE PROCESS FLOW OF THE CONSTRUCTION OF OBJECTS IN NIS-NAFTAGAS PROMET ACCORDING TO JUS ISO 9001:2000 SERIES
- D-2. Barac N., Milovanović G. (Niš - Serbia and Montenegro), Cvetković S. (Kosovska Mitrovica - Serbia and Montenegro)
LOGISTIC QUALITY AND QUALITY ANALYSIS TECHNIQUES
- D-3. Bărsan-Pîpu N., Șimon A. E. (Brasov - Romania)
USING THE PRINCIPAL COMPONENT ANALYSIS FOR MULTIVARIATE PROCESS MONITORING
- D-4. Bločanin R. (Belgrade - Serbia and Montenegro), Božović-Simić S. (Kruševac - Serbia and Montenegro)
ENVIRONMENT PROTECTION BASED ON THE CHEMICAL ACCIDENTS CONSEQUENCES PROGNOSSES
- D-5. Brković M. (Novi Bečej - Serbia and Montenegro), Desnica E., Nikolić M. (Zrenjanin - Serbia and Montenegro)
REVIEW OF THE QUALITY CONTROL PROCEDURE FOR T-E PROCESS OF ROOF TILE SHAPING
- D-6. Bulatović M. (Podgorica - Serbia and Montenegro)
REENGINEERING OF DESIGN AND MANAGEMENT IN FUNCTION OF TQM AND BUSINESS EXCELLENCE
- D-7. Cioca L. I., Breaz R. E. (Sibiu - Romania)
MANAGERIAL DECISION MAKING SYSTEMS FOR REENGINEERING THE PRODUCTION SYSTEMS
- D-8. Cîlnclu M. R. (Codlea - Romania), Cîlnclu R. (Brasov - Romania)
STUDY ON THE VARIABILITY OF THE MEASURING PROCESS AND ITS INFLUENCE ON THE METROLOGICAL RELIABILITY
- D-9. Cîlnclu R. (Brasov - Romania), Cîlnclu M. R. (Codlea - Romania)
METROLOGICAL RELIABILITY - A FUNCTION OF THE PARAMETER DEVIATION. STUDY ON SIMULATED AND EXPERIMENTAL DATA
- D-10. Cvetković S. (Kosovska Mitrovica - Serbia and Montenegro), Barac N., Milovanović G. (Niš - Serbia and Montenegro)
DEVELOPMENT OF MANUFACTURING CONTROL
- D-11. Čurčić S., Ježenica R. (Čačak - Serbia and Montenegro)
REENGINEERING PREFABRICATED SYSTEMS IN FUNCTION FLEXIBILITY AND PRODUCTIVITY
- D-12. Đorđević Lj. (Kraljevo - Serbia and Montenegro), Novaković-Rajčić B. (Belgrade - Serbia and Montenegro), Đurić S., Veselinović S. (Kruševac - Serbia and Montenegro)
JUSTIFICATION FOR NATURAL GAS APPLICATION INSTEAD OF OTHER ENERGY SOURCES
- D-13. Đorđević V., Janković-Milić V. (Niš - Serbia and Montenegro)
TOTAL QUALITY MANAGEMENT

- D-14. Đuričić M. (Užice - Serbia and Montenegro), Đuričić M. (Belgrade - Serbia and Montenegro), Miliutinović I., Drndarević D., Soklić M. (Užice - Serbia and Montenegro) QMS ESTABLISHMENT IN THE DEVELOPING COUNTRIES; ABILITIES FOR BUSINESS SYSTEM EXCELLENCE
- D-15. Ghorasimov A., Mihal P., Mnerić D., Tucu D. (Timisoara - Romania) STUDY ABOUT TRACEABILITY IN FORCE MEASUREMENT IN ROMANIA
- D-16. Hristov H. K. (Gabrovo - Bulgaria) MEASUREMENT ERRORS OF LINEAR DIMENSIONS WITH MEASURABLE WHEEL
- D-17. Iancu A., Mangra M. (Turnu Severin - Romania) SEVERAL OBSERVATIONS ON THE TOTAL QUALITY MANAGEMENT
- D-18. Jačmenica R. (Čačak - Serbia and Montenegro), Dašić P., Marić A. (Kruševac - Serbia and Montenegro) RATIONALIZATION OF PRODUCT EQUIPMENT FOR TECHNOLOGICAL PROCESS OF BREAD PRODUCTION BY MEANS OF PARETO METHOD
- D-19. Jermann R., Sereş P. (Regija - Romania) GUIDANCE OF QUALITY MANAGEMENT SYSTEM BY MEANS OF OBJECT VES
- D-20. Jovanović D. (Novi Sad - Serbia and Montenegro), Mitojković-Leković B. (Belgrade - Serbia and Montenegro), Vujković I., Matavulj M. (Novi Sad - Serbia and Montenegro) INTRODUCTION OF NEW ISO-14000 STANDARDS IN SERBIA AND EXPECTED ENVIRONMENTAL CONSEQUENCES
- D-21. Koleňák J., Nývltová R., Polák D., Chybová L. (Brno - Czech Republic) GROWING COMPETITIVENESS OF INDUSTRIAL FIRMS BY COLLABORATION ARRANGEMENTS
- D-22. Krlev T., Krleva N., Polenakovik R. (Skopje - Republic of Macedonia) OPERATIONS MANAGEMENT STUDIES PRODUCTION OF PRODUCTS AND/OR SERVICES
- D-23. Lukić V. (Kruševac - Serbia and Montenegro) LIMITATIONS OF EFFICIENT CONTROL OF PROTECTION OF NATURE ENVIRONMENT AND STANDARDS OF SERIES JUS ISO 14000
- D-24. Lumntzer E., Králiková R. (Košice - Slovakia) SIMULATION UTILIZE FOR INCREASING EFFECTIVENESS OF THE INTEGRATED PRODUCTION
- D-25. Matoušková D., Sýkorová L. (Zlín - Czech Republic) THE STATISTICAL METHODS APPLICATION AT INJECTION MOULDING PRODUCTION
- D-26. Militaru C., Militaru R. (Timisoara - Romania) MODERN TOOLS AND TECHNIQUES OF QUALITY MANAGEMENT
- D-27. Militaru R. (Timisoara - Romania) IDENTIFYING THE ENVIRONMENTAL ASPECTS AND ASSESSING THEIR ASSOCIATED IMPACTS IN AN ENVIRONMENTAL MANAGEMENT SYSTEM IN CONFORMITY TO ISO 14000
- D-28. Mitlić D. (Niš - Serbia and Montenegro), Đurić S., Marić A. (Kruševac - Serbia and Montenegro) TECHNO-ECONOMIC ADEQUACY FOR THE SELF-SHIELDING CORED WIRE WELDING APPLICATION
- D-29. Nikolić M., Sajfert Z., Nikolić B. (Zrenjanin - Serbia and Montenegro) SELECTION OF IDEAS FOR NEW PRODUCTS IN A FURNITURE MANUFACTURING COMPANY
- D-30. Nikolić S. (Novi Sad - Serbia and Montenegro) MECHANICAL ENGINEERING IN THE LIGHT CONTROVERSIES IN MANAGEMENT (EAGLES DO NOT FLY IN FLOCKS OR MAYBE THEY DO)
- D-31. Polenakovik R., Krlev T., Polenakovik L. (Skopje - Republic of Macedonia) RELATIONSHIP BETWEEN TYPE OF TECHNOLOGY AND SPAN OF MANAGEMENT
- D-32. Popescu N. (Bucharest - Romania) TAGUCHI'S "QUALITY LOSS FUNCTION" (QLF) APPLICABILITY IN THE DIMENSIONAL ACCURACY AND ISO FITTINGS THEORETICAL FIELD
- D-33. Romić L. (Subotica - Serbia and Montenegro) THE IMPORTANCE OF TECHNOLOGICAL INNOVATIONS IN SMALL AND MEDIUM FIRMS
- D-34. Sajfert Z., Nikolić M., Desnica E. (Zrenjanin - Serbia and Montenegro) MODERN CONCEPTS OF INDUSTRIAL PRODUCTION

- D-35. Slavov Z. D. (Varna - Bulgaria) A HIERARCHICAL METHOD FOR DECISION MAKING UNDER MULTIPLE CRITERIA IN THE MANAGEMENT OF MECHANICAL ENGINEERING
- D-36. Stojanović S. (Kruševac - Serbia and Montenegro) PREPARATION OF SERBIA AND MONTENEGRO FOR EUROPEAN INTEGRATION - LIMITATION FOR ACCULTURATION OF MACHINE MANUFACTURE
- D-37. Subeska V., Krlev T., Polenakovik R., Todorovski N. (Skopje - Republic of Macedonia) HOW TO MANAGE FREQUENT CHANGES IN PRODUCTION/SERVICE ORDERS?
- D-38. Štefánek M., Janáč A., Milič A. (Trnava - Slovakia) ASSEMBLABILITY FROM ASPECT OF METROLOGY
- D-39. Tomášková E., Sýkorová S. (Brno - Czech Republic) THE IMPORTANCE OF MARKETING FOR MANAGEMENT IN MECHANICAL ENGINEERING
- D-40. Trifunović S. (Kraljevo - Serbia and Montenegro), Babović D. (Kruševac - Serbia and Montenegro) TIME AS THE FACTOR OF WORK HARMS IN THE INDUSTRIAL CONDITIONS OF MINTAGE - RESULTS OF RESEARCH
- D-41. Văcărescu V. (Timisoara - Romania), Golovatal-Schmidt E. (Herzogenaurach - Germany) IMPLICATIONS OF TAGUCHI'S QUALITY LOSS FUNCTION ON DEVELOPMENT AND DESIGN FOR BULK GOODS IN THE AUTOMOTIVE FIELD
- D-42. Vachev B., Ilieva K. (Sofia - Bulgaria), Pulev B. (Gabrovo - Bulgaria) SYSTEM ANALYSIS OF QUALITY MANAGEMENT SYSTEM - DECISION MAKING APPROACH, MEASUREMENT, ANALYSIS AND IMPROVEMENT
- D-43. Zalmević-Uzunović N., Lemeš S., Hadžikadunić F., Vučković N. (Zenica - Bosnia and Herzegovina) STEAM BOILER DISPLACEMENTS AS INDICATORS FOR CORRECT PROCESS CONDUCTING
- D-44. Zhelezarov I. S., Hristov H. K. (Gabrovo - Bulgaria) QUALITY MANAGEMENT SYSTEM - FACTOR FOR SUCCESSFUL ACCREDITATION OF HIGHER TECHNICAL INSTITUTE
- D-45. Živković D. (Zrenjanin - Serbia and Montenegro) PRODUCTIVITY AS ONE OF THE CRITERIA FOR SELECTION OF AUTOMATIZATION LEVEL OF PRODUCTION EQUIPMENT

Papers for Session E: / Radovi za sekciju E:
CA TECHNOLOGIES (CAD, CAM, CAPP, CAE, ...) AND CIM

- E-1. Alexandru C., Vişu I. (Braşov - Romania) DYNAMIC ANALYSIS OF A FULL VIRTUAL VEHICLE IN PASSING OVER BUMPS REGIME
- E-2. Alexandru C., Vişu I. (Braşov - Romania) REALIZATION OF A DIGITAL CAR USING FUNCTIONAL VIRTUAL PROTOTYPING TECHNOLOGY
- E-3. Andreica G. E., Talabă D. (Braşov - Romania) A COMPARATIVE ANALYSIS OF CAR'S DOUBLE WISH-BONE SUB-TYPES SUSPENSIONS COMBINATIONS REGARDING THE ROLL MOTION
- E-4. Argeşanu V., Popa A. (Timişoara - Romania) INTERFACE CONTACT PRESSURE DISTRIBUTION IN DYNAMIC CONTACT FACE SEALS, ANALYZED BY FEM
- E-5. Borsan A., Borsan L. (Braşov - Romania) CONSIDERATIONS CONCERNING GENEVA MECHANISM DRIVEN BY A CAM MECHANISM

- E-6. Barsan L., Barsan A., Neagoe M. (Brasov - Romania)
CONSIDERATIONS CONCERNING SOME REPRESENTATIVE CORRELATIONS
OPTIMIZATION IN CAM MECHANISMS SYNTHESIS
- E-7. Batog I., Lihotchi I. (Brasov - Romania)
SIMULATION AND DYNAMIC ANALYSIS OF VIBRATING MACHINES USING CAE
- E-8. Bogomolov D. G., Poroshin V. V. (Moscow - Russia)
PROGRAM COMPLEX FOR ESTIMATING AND DESIGN OF THE HERMETICAL JOINTS
- E-9. Bondrea I., Avrigean E. (Sibiu - Romania)
MODELLING AND OPTIMISATION OF THE COMPONENTS OF THE CARDAN
TRANSMISSION BY MEANS OF CAD SOFTWARE AND DATABASES
- E-10. Botea T., Pamintas E. (Timisoara - Romania)
CAE FOR CAM ACTUATED LATHES
- E-11. Botea T., Pamintas E. (Timisoara - Romania)
CASE STUDY ABOUT ECONOMIC EFFICIENCY OF COMPUTER AIDED DESIGN OF
TECHNOLOGICAL PROCESS ON CAM-ACTUATED LATHES
- E-12. Butnaru S., Jula A. (Brasov - Romania)
ASPECTS OF FINITE ELEMENT ANALYSIS OF THE BELTS TOOTH DEFORMATION
- E-13. Cătană D., Trif N. (Braşov - Romania)
THE SIMULATION OF DEFORMATION AT TRACTION OF SPOTS WELDED JOINTS
- E-14. Ciobaia V., Sche I., Podoreanu A., Curtu I., Dogaru F. (Brasov - Romania)
A STUDY OF SAFTY BELT DOUBLE BELT GUIDE ASPECTS UNDER TENSION
- E-15. Cînciu R. (Brasov - Romania), Cînciu M. R. (Codlea - Romania)
AUTOLISP ROUTINE FOR QUICK REPRESENTATION AND INTERSECTION OF SOLIDS
- E-16. Cvetković D., Kostić I., Mitrović Č., Bengin A., Bekrić D. (Belgrade - Serbia and
Montenegro)
POWER STATION'S COOLING TOWER COMPOSITE FAN BLADE
- E-17. Damjanović B. (Kruševac - Serbia and Montenegro)
CNC TOOLPATH SIMULATION AND CONTROL SOFTWARE BASED ON BRESENHAM'S
ALGORITHM
- E-18. Davidescu A., Sticlaru C. (Timisoara - Romania)
THE DYNAMIC ANALYSIS OF A FOUR-BAR LINKAGE BY FINITE ELEMENT METHOD
- E-19. Deaconescu A. (Braşov - Romania)
COMPUTER AIDED DETERMINATION OF THE CAPABILITY INDICES OF WORKING
MACHINES
- E-20. Dibner Yu., Kruk A. (Voronezh - Russia)
PROJECTION OF THE DESIGNER HOT-PRESS DATABASE
- E-21. Dikov A., Guergov S., Dikov R. (Sofia - Bulgaria)
GENERALIZED TOPOLOGICAL MODEL OF THE DIMENSIONAL CHARACTERISTICS
OF MANIPULATIONAL SUBSYSTEMS OF INDUSTRIAL ROBOTS WITH OPEN
KINEMATIC STRUCTURE
- E-22. Dolga L. (Timisoara - Romania), Stefanescu D. M. (Bucharest - Romania)
ABOUT THE PARAMETRIC AND FEATURE-BASED DESIGN MODELS FOR THE
ELASTIC ELEMENTS OF FORCE TRANSDUCERS
- E-23. Dolga V. (Timisoara - Romania)
ABOUT THE COMPUTER AIDED DESIGN OF THE TORQUE SENSORS
- E-24. Drăgulescu D., Toth-Taşcău M., Drucean M. (Timisoara - Romania)
IMPROVING THE PATH PLANNING PROCESS USING POTENTIAL FIELD METHOD
- E-25. Drucean M., Drăgulescu D., Toth-Taşcău M. (Timisoara - Romania)
ADAPTIVE CONTROL OF MOBILE TRANSFER SYSTEMS BASED ON THE THEORY OF
SUBJECTIVE PROBABILITIES
- E-26. Dumitracu C. (Constanta - Romania), Comandar C. (Iasi - Romania), Sabău A.
(Constanta - Romania), Amariei N. (Iasi - Romania)
COMPUTATIONAL MODEL OF OPTIMIZATION THERMAL STRESS-RELIEF
PROCESSES AT CARBON STEEL
- E-27. Dumitru N., Duta A., Săss L. (Craiova - Romania)
THE FINITE ELEMENT MODELING OF THE STRUCTURES IN STATICAL MODE

- E-28. Duncheva G. V. (Gabrovo - Bulgaria)
INVESTIGATION OF THE IMPACT OF A DEVIATION IN A REGULAR GEOMETRICAL
FORM IN LONGITUDINAL DIRECTION ON THE STRESSED STATE AND THE LOAD
CARRYING CAPACITY OF MOULDED TAPER JOINTS
- E-29. Eftimie E. (Braşov - Romania)
GECMETRIC MODELLING OF THE 3D CURVES UNIFORM E-SPLINE CURVES
- E-30. Eftimie E., Jula A. (Braşov - Romania)
SIMPLE CLUTCHES WITH MULTIPLE FUNCTIONS ELASTIC AND SAFETY CLUTCHES
- E-31. Eftimie N. (Braşov - Romania)
GEOMETRIC MODELLING OF THE 3D CURVES CUBIC BETA SPLINES
- E-32. Eftimie N. (Braşov - Romania)
PRCGRAMMES FOR THE 3D REPRESENTATIONS OF OBJECTS AND SURFACES
- E-33. Erić D. (Čačak - Serbia and Montenegro)
DEFINITION KNOWLEDGE BASE WITH ELEMENTS ARTIFICIAL INTELLIGENCE AS
SEGMENT CAPP SYSTEM FOR EDM-TECHNOLOGY
- E-34. Gecevska V., Pavlovski V. (Skopje - Republic of Macedonia), Popovska-Vasilevska S.
(Bitola - Republic of Macedonia), Rosomanov Z. (Skopje - Republic of Macedonia)
COMPUTER AIDED MANUFACTURING AS AN INFORMATION TECHNOLOGY IN
PRESS PRODUCTION
- E-35. Gordić D., Babić M., Jovičić N., Sušteršić V. (Kragujevac - Serbia and Montenegro)
VARIOUS ASPECTS OF COMPUTER APPLICATIONS IN FLUID POWER
- E-36. Ivan M. C., Ivan C., Lăncea C., Ivan N. V. (Brasov - Romania)
THE USE OF 3D CONSTRUCTIVE TECHNOLOGICAL ENTITIES IN PRODUCT
DEVELOPMENT
- E-37. Ivanov G. I., Naydenov A. P. (Gabrovo - Bulgaria)
DEFINING THE PROFILE OF A DISK CAM AND MACROPROGRAMMING WHILE
MILLING IT ON CM 040 MACHINING CENTRE WITH TCY600M CNC SYSTEM
- E-38. Jallu C., Neagoe M., Săulescu R. (Braşov - Romania)
ON THE DYNAMIC MODELING OF A VERTEBRATE ROBOT WITH GEARS. NUMERICAL
SIMULATION
- E-39. Jianu S. (Rojăta - Romania)
APPLICATIONS OF COMPUTER AIDED TECHNIQUES IN RESEARCH ACTIVITY IN THE
DOMAIN OF HYDRAULIC TURBINE AT S.C. U.C.M. REŞIŢA S.A.
- E-40. Jovičić N., Ivanović A., Gordić D., Babić M., Sušteršić V. (Kragujevac - Serbia and
Montenegro)
COMPUTER AIDED DESIGN OF A WIND TURBINE BLADE
- E-41. Karabegović I., Bohrem Š. (Bihać - Bosnia and Herzegovina), Doleček V. (Sarajevo -
Bosnia and Herzegovina)
CONTRIBUTION TO APPLICATION OF SIMULATION IN INDUSTRIAL ROBOTICS
- E-42. Letić D., Desnica E. (Zrenjanin - Serbia and Montenegro)
CAD TECHNOLOGY APPLICATION IN CAM MECHANISMS DESIGN
- E-43. Lihotchi I., Batog I. (Brasov - Romania)
CONTRIBUTIONS TO 3D VISUALISATION IN AUTOCAD
- E-44. Liviu M. (Cluj-Napoca - Romania), Ioan M. (Oradea - Romania), Ganea Calin-Cristian
G. (Windsor - Canada), Macodon G. (Oradea - Romania)
TWO AXES CNC MILLING HEAD, MIDDLE AND SMALL SIZE, FOR THE MOULD
PERFORMING
- E-45. Mishev G., Lafchiev G., Litov. Sv. (Plovdiv - Bulgaria)
INTRODUCING COMPUTER INTEGRATED SYSTEM IN MACH NE-BUILDING
FACORIES WITH MEDIUM SERIAL TYPE OF PRODUCTION
- E-46. Neagoe M., Jallu C., Creţescu N. (Braşov - Romania)
HIGH DEGREE MODELLING OF ERRORS IN ROBOT CHAINS, PART I: CORRELATIONS
BETWEEN ERRORS
- E-47. Neagoe M., Jallu C., Creţescu N. (Braşov - Romania)
HIGH DEGREE MODELING OF ERRORS IN ROBOT CHAINS, PART II: ROBOT ERROR
MODELING
- E-48. Novac Gh., Markos Z., Baţes L. (Braşov - Romania)
THE COMPUTER ASSISTED DESIGN OF CARBURIZING PARAMETERS

- E-49. **Panov S., Phileva R. (Sofia - Bulgaria)**
APPLICATION OF THE FINITE AUTOMATA TO THE CONTROL OF ROBOTS
- E-50. **Prelasch Z. (Regija - Romania)**
CONSIDERATIONS CONCERNING DESIGN AND MANUFACTURING AT S.C. U.C.M. REȘIȚA S.A. OF HOLLOW JET VALVE WITH INLET DIAMETER OF 1.6 M
- E-51. **Radu C. (Brașov - Romania)**
PARAMETRIZATION OF FLEXIBLE HELICAL COUPLINGS
- E-52. **Radu C. (Brașov - Romania)**
STUDY OF FLEXIBLE HELICAL COUPLINGS USING FINITE ELEMENT METHOD ANALYSIS
- E-53. **Sankausklone T. (Kaunas - Lithuania)**
INVESTIGATION OF INFLUENCE OF ADDITIONAL AND CONSTANT MASS RELATIONSHIP ON DYNAMICS OF THE VARIABLE MASS MANIPULATION SYSTEM
- E-54. **Săvescu D., Latog M., Păun M. (Brașov - Romania)**
STRESS ANALYSIS IN BALL-BEARING RINGS USING FEM
- E-55. **Sidorenko S., Dukovski V., Kandikjan T. (Skopje - Republic of Macedonia)**
THE IMPLICATION OF GEOMETRIC INACCURACY OF NC MACHINE ON THE VIRTUAL NC MACHINING PROCESS
- E-56. **Simion I. (Bucharest - Romania)**
INFOGRAPHIC ON THE FIXTURE DESIGN
- E-57. **Śladkowski A., Sitarz M., Śladkowski J. (Katowice - Poland)**
RESEARCH OF THE STRESSES IN THE LARGE-GRAIN GEARINGS
- E-58. **Stanciu D. (Timișoara - Romania)**
GRAPHIC STUDY ON HUMAN JAW AND FEA
- E-59. **Stanciu D. (Timișoara - Romania)**
THE INTERSECT FUNCTION IN VECTOR GRAPHICS SOFTWARE
- E-60. **Stan Gh. (Bacău - Romania)**
FACTORS DETERMINING THE RIGIDITY OF KINEMATIC LINKAGES WITH LEAD SCREW, EQUIPPING THE INDUSTRIAL ROBOTS
- E-61. **Trif I. N. (Brașov - Romania), Joni N., Joni A. (Timișoara - Romania)**
DESIGN ASPECTS OF ROBOTIC ARC WELDED JOINTS
- E-62. **Varga S., Radulescu C. (Timișoara - Romania)**
USING THE POSITIONS PROBLEM AT THE ACAD SYNTHESIS OF THE WHEEL TEETH PROFILE FOR SYNCHRONOUS TRANSMISSION WITH TIMING BELT
- E-63. **Vajšbek K., Košťál P., Pastierovič M. (Bratislava - Slovakia)**
INTELLIGENT FIXTURES
- E-64. **Vajšbek K., Matúšová M. (Bratislava - Slovakia)**
ALGORITHM OF FIXTURE DESIGN
- E-65. **Žaludek M., Šuba O., Maňas M., Maláč J. (Zlín - Czech Republic)**
COMPARISON OF MECHANICAL BEHAVIOR OF THE PARTS PRODUCED BY FDM AND LS METHODS OF RP TECHNOLOGY

Papers for Session F: / Radovi za sekciju F:
APPLICATION OF INFORMATION TECHNOLOGIES IN
MECHANICAL ENGINEERING

- F-1. **Baláž V., Daneshjo N., Madáč K., Šalátová M. (Košice - Slovakia)**
INFORMATION-CONTROLLING SYSTEMS OF PRODUCTION CELLS WITH APPLICATION OF WEB TECHNOLOGY
- F-2. **Cloca M. (Sibiu - Romania)**
APPLICATION OF INFORMATION TECHNOLOGIES AND COMMUNICATIONS IN MECHANICAL ENGINEERING: USING WEB TECHNOLOGIES, INTERNET AND E-CASE INSTRUMENTS

- F-3. **Cloca M. (Sibiu - Romania), Buraga S. C. (Iasi - Romania)**
INSTRUMENTS AND WEB TECHNOLOGIES FOR IMPLEMENTING ARCHITECTURES AND INTEGRATION INFORMATICS SYSTEMS IN VIRTUAL ENTERPRISE
- F-4. **Dašić P. (Kruševac - Serbia and Montenegro)**
ONE CLASSIFICATION EXAMPLE OF INFORMATION TECHNOLOGY APPLICATION IN INDUSTRY
- F-5. **Drndarević D., Djuričić M., Milutinović I. (Užice - Serbia and Montenegro)**
NEURAL NETWORKS IN PROCESSES MODELLING
- F-6. **Fidan T., Amalîk S. M., Killç E. S. (Ankara - Turkey)**
CONCEPT OF STEP AP224 FEATURES BASED MODELING FOR ROTATIONAL PARTS
- F-7. **Gavril Z. (Kruševac - Serbia and Montenegro)**
REVIEW OF THE LATEST ICT TOOLS FOR ENGINEERING DESIGN
- F-8. **Ivanov D. (Saint Petersburg - Russia)**
A CONCEPTION OF A MODEL-BASED SYSTEM OF OPERATIVE ORDER CONTROL IN COOPERATIVE PRODUCTION NETWORKS WITH THE USE OF INTELLIGENT AGENTS
- F-9. **Jenkolo J., Sluga A. (Ljubljana - Slovenia)**
WEB BASED SHOP FLOOR MONITORING
- F-10. **Karabegović I. (Bihać - Bosnia and Herzegovina), Vojčić S. (Bihać - Bosnia and Herzegovina), Doleček V. (Sarajevo - Bosnia and Herzegovina)**
TELEROBOTICS APPLICATIONS WITH INTERNET ASSISTANCE
- F-11. **Kartunov S. K., Petrova D. I. (Gabrovo - Bulgaria)**
DATABASE MANAGEMENT SYSTEM FOR AUTOMATED DESIGN OF MICROMECHANICAL COMPONENTS FOR PRODUCTS IN MICROSYSTEM ENGINEERING
- F-12. **Marta C., Sporea I. (Timișoara - Romania)**
COMPATIBILITY BETWEEN SIMULATION AND TESTS OF 100 MM BALLS FROM AUSTENITIC MANGANESE STEEL (OAM) OF HATFIELD
- F-13. **Sarı B., Killç S. E., Şen T. (Ankara - Turkey)**
WEB BASED OPTIMIZATION SYSTEM FOR MACHINING OPERATIONS
- F-14. **Stefanović M. D., Banović Ž. A. (Novi Sad - Serbia and Montenegro)**
STRUCTURAL SYSTEM ANALYSIS IN FUNCTION CONTEXT ANALYSIS OF TOOLS AND EQUIPMENT RESOURCES USING ORACLE CASE TOOL DESIGNER 6i
- F-15. **Taštin Z. (Belgrade - Serbia and Montenegro), Jovanović V., Ostojić G. (Novi Sad - Serbia and Montenegro), Ostojić M. (Belgrade - Serbia and Montenegro), Taštin S. (Novi Sad - Serbia and Montenegro)**
DATA ACQUISITION, MONITORING AND VISUALIZATION OF HEAT EXCHANGING PROCESS USING PROGRAMMABLE CONTROLLER AND HUMAN-MACHINE INTERFACE
- F-16. **Zoller C., Simaschevici H. (Petrosani - Romania)**
VIRTUAL MECHANICAL STRAIN BRIDGE INSTRUMENT

Papers for Session G: / Radovi za sekciju G:
APPLICATION OF MECHANICAL ENGINEERING IN OTHER
INDUSTRIAL FIELDS

- G-1. **Amariei N., Comandar C., Leon D. (Iasi - Romania), Dumitrache C. (Constanța - Romania)**
ISOCHRONOUS CREEP CURVES FOR A NITRIDING STEEL
- G-2. **Andreescu F. (Brașov - Romania)**
ELECTRICAL FIELDS, CURRENT DENSITIES AND ANALYTICAL CONDITIONS REGARDING THE STATIONARY DISCHARGE OF THE ARC WITH THERMOELECTRONIC AND AUTOELECTRONIC EMISSION
- G-3. **Andreescu F., Andreescu B. (Brașov - Romania)**
PHYSICAL PHENOMENA TAKING PLACE IN THE ARC COLUMN

- G-4. Andreev A. B., Racheva M. R. (Gabrovo - Bulgaria)
BOUNDS OF THE ESSENTIAL FREQUENCY FOR THE FOURTH - ORDER PROBLEMS CONTAINING THE EIGENVALUE PARAMETER IN THE BOUNDARY CONDITIONS
- G-5. Anghel G., Tucu D., Mnerie D. (Timisoara - Romania)
ELEMENTS OF MECHANICAL ENGINEERING FOR LYOPHILIZATION TECHNOLOGY
- G-6. Argosanu V. (Timisoara - Romania)
THE ERGONOMIC DESIGN OF A MEDICAL OPERATION ROOM
- G-7. Arzamaszova G., Zelenina A. (Voronezh - Russia)
SPATIAL OSCILLATIONS
- G-8. Atanasova Y., Rashkova Y. (Gabrovo - Bulgaria)
USING THE ELEMENTS OF I-a, II-a, III-a, III-b, IV-b, V-b, VI-b GROUPS AS REDUCTORS IN SATURATION WITH ELEMENTS OF THIRD PRINCIPAL GROUP
- G-9. Bakšys B., Fedaravičius A., Piodziunlopė N. (Kaunas - Lithuania)
VIBRATORY COMPENSATION OF INTERDEPENDENT POSITION ERROR OF AUTOMATICALLY ASSEMBLED PARTS
- G-10. Bauk S., Dragović B. (Kotor - Serbia and Montenegro)
THEORETICAL APPROACH TO SOME CONTAINER YARD AGV ROUTING PROBLEMS
- G-11. Bauriene G., Bubulis A., Pilkauskas K. (Kaunas - Lithuania)
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Number of papers by countries

No.	Country	Number of papers	No.	Country	Number of papers
1.	Azerbaijan	1	12.	Macedonia	5
2.	Bosnia and Herzegovina	6	13.	Poland	4
3.	Bulgaria	52	14.	Romania	168
4.	Croatia	1	15.	Russia	21
5.	Czech Republic	7	16.	Serbia and Montenegro	88
6.	Finland	2	17.	Slovakia	6
7.	France	1	18.	Slovenia	4
8.	Germany	2	19.	Switzerland	1
9.	Greece	1	20.	Turkey	3
10.	Italy	2	21.	Ukraine	9
11.	Lithuania	6	22.	USA	1
				Totally:	391

GENERAL INFORMATION OPŠTE INFORMACIJE

Place of keeping: Herceg Novi Mosto održavaanja: Herceg Novi

Herceg Novi is situated at the entrance of the Boka Kotorska Gulf in Mediterenian, cuddling among numerous species of tropical and subtropical plants. This is the film festival and carnival metropolis! For almost three decades there has been a festival on glorifying the flower mimosa.

Like nature, history has also left the rich heritage with the seals of different epochs and the important art treasures.

Since it was the latest town founded on the Adriatic coast it was named Novi, meaning "the latest". Its present name dates back from time when the town was run by Hertzeg Stjepan Vukčić Kosača when town flourished. These days it is well-known as the center of health tourism, with the famous spa resort Igalo.

Herceg Novi is 120 km westward from Podgorica, 100 km westward from Bar, 20 km westward from Tivat, 600 km southward from Belgrad, 630 km southwestward from Niš and 25 km eastward from Dubrovnik.

Herceg Novi je smešten na ulazu u Bokokotorski zaliv, raskošno ispunjen tropskim i suprotropskim raslinjem. To je grad filmskog festivala i karnevala. Već tri decenije se održava festival mimoza.

Poput prirodnog nasleđja, grad ima i ono istorijsko, jer su različite epohe ostavile svoj pečat i značajno umetničko blago.

Grad je nazvan Novi kao poslednji osnovan grad na jadranskoj obali. Njegovo današnje ime Herceg Novi datira iz vremena procvata tokom vladavine hercega Stjepan Vukčića Kosača.

Danas je grad poznat i kao centar zdravstvenog turizma sa poznatom banjom Igalo.

Herceg Novi je 120 km zapadno od Podgorice, 100 km zapadno od Bara, 20 km zapadno od Tivta, 600 km južno od Beograda, 630 km jugo-zapadno od Niša i 25 km istočno od Dubrovnika.

Arrival in Herceg Novi:

By car

From Belgrad by relation: Belgrad - Ljig - Gornji Milanovac - Čačak - Požega - Užice - Nova Varoš - Prijepolje - Bijelo Polje - Mojkovac - Kolašin - Podgorica - Cetinje - Budva - Lepetane - Kamenari - Herceg Novi.

From Niš by relation: Niš - Kruševac - Kraljevo - Čačak - Požega - Užice - Nova Varoš - Prijepolje - Bijelo Polje - Mojkovac - Kolašin - Podgorica - Cetinje - Budva - Lepetane - Kamenari - Herceg Novi or

Niš - Kruševac - Kraljevo - Raška - Novi Pazar - Ribariće - Rožaje - Berane - Mojkovac - Kolašin - Podgorica - Cetinje - Budva - Lepetane - Kamenari - Herceg Novi
Hotel has car parking.

By plane

Airport is in the Belgrade, Podgorica, Tivat and Dubrovnik. From Belgrade to Podgorica and Tivat it has normal air-line.

Price of return air-ticket Beograd - Tivat - Beograd is: 155,- EUR
in price are implied: return air-ticket, airport

Dolazak u Herceg Novi:

Kolima

Iz Beograda relacijom: Beograd - Ljig - Gornji Milanovac - Čačak - Požega - Užice - Nova Varoš - Prijepolje - Bijelo Polje - Mojkovac - Kolašin - Podgorica - Cetinje - Budva - Lepetane - Kamenari - Herceg Novi.

Iz Niša relacijom: Niš - Kruševac - Kraljevo - Čačak - Požega - Užice - Nova Varoš - Prijepolje - Bijelo Polje - Mojkovac - Kolašin - Podgorica - Cetinje - Budva - Lepetane - Kamenari - Herceg Novi ili

Niš - Kruševac - Kraljevo - Raška - Novi Pazar - Ribariće - Rožaje - Berane - Mojkovac - Kolašin - Podgorica - Cetinje - Budva - Lepetane - Kamenari - Herceg Novi
Hotel ima parking.

Avionom

Aerodrom je u Beogradu, Podgorici, Tivu i Dubrovniku. Od Beograda do Podgorice i Tivta ima redovna avio linija.

Cena povratne avio karte Beograd - Tivat - Beograd je: 155,- EUR
U cenu su uračunate povratna avionska karta.

and security's tariff, bus transportation from air-port Tivat to hotel and vice versa.

Reservation and sale of air-tickets you can do by tourist agency "SKY PASS" - Belgrade.

By bus

- From Belgrade to Herceg Novi bus go in:
16.00 17.30 19.00 20.00
21.20 22.00

Price of return bus-ticket Belgrade – Herceg Novi – Belgrade is: od 24,- to 32,5 EUR, depending from carrier.

- from Niš to Herceg Novi bus go in: 19.00

Price of return bus-ticket Niš – Herceg Novi - Niš is: 27,- EUR.

From bus station to Hotel "Plaža" is - 200 m.

Upon arrival accommodate first. If there is time go to the Conference Office and register (on reception desk in hotel "Plaža"). If you are late please go directly to Conference Opening Ceremony. You can register later.

Participation fee:

For first autor participation is free.

Participation fee for another authors and participants is: 50,- EUR. Participation fee comprise: participation in Conference, Proceedings, CD-ROM, other materials and cocktails.

Registration and fees:

Proceedings, CD-ROM and other materials will give to participants on registration desk in hotel "Plaža".

The registration desk will be open on Friday September 19, 2003, from 12⁰⁰ to 20⁰⁰ at Hotel "Plaža".

The Secretariat will also operate during the Conference.

For foreign participants payment of registration fee is in cash on registration desk. Credit cards are not accepted.

aerodromska i bezbedonosna taksa, organizovan autobuski prevoz od tivatskog aerodroma do hotela i obratno.

Rezervacija i prodaja avio karata vrši se kod turističke agencije: "SKY PASS" - Beograd.

Autobusom:

- iz Beograda za Herceg Novi autobus polazi u:
16.00 17.30 19.00 20.00
21.20 22.00

Cena povratne autobuske karte Beograd – Herceg Novi - Beograd je: od 1600, do 2150, din, zavisno od prevoznika.

- iz Niša za Herceg Novi autobus polazi u: 19.00

Cena povratne autobuske karte Niš – Herceg Novi - Niš je: 1800,00 din.

Od Autobuske stanice do Hotela "Plaža" je -200 m.

Po dolasku u Herceg Novi prvo se smestite. Ako imate vremena prijavite se na Registracionom mestu Konferencije (do recepcije u hotelu "Plaža"). Ako kasnite molimo Vas da odete direktno na Ceremoniju otvaranja konferencije. Možete i kasnije da se prijavite.

Kotizacija:

Prvi autori su oslobođeni plaćanja kotizacije. Kotizacija za ostale autore i učesnike konferencije iznosi: 3.000,00 din. Kotizacija obuhvata: prisustvo konferenciji, zbornik radova, CD-ROM, ostali štampani materijal i koktele.

Registracija i plaćanje:

Zbornici radova, CD-ROM i ostali štampani materijal će biti uručeni učesnicima na registracionom mestu u hotelu "Plaža".

Registraciono mesto će biti otvoreno u petak 19. septembra 2003, od 12⁰⁰ do 20⁰⁰ u Hotelu "Plaža".

Organizacioni sekretarijat će raditi tokom cele Konferencije.

Za domaće učesnike kotizacija se može platiti preko žiro računa. Više tehničke mašinske škole Trstenik: 840-81-8660-91 kod Uprave za javna plaćanja sa naznakom "kotizacija za RaDMI 2003" ili direktno pri evdeniranju na registracionom mestu na dan dolaska.

Accommodation:

Accommodation capacities have been reserved both in Hotel "Plaža" of Herceg Novi.

Hotel Plaža (A category: ****) is situated downtown, on the very shoreline, on the Pet Danica Promenade.

Each room has balcony looking onto the sea, bathroom, toilet, telephone and radio. All appartments have color TV set in addition. The hotel has summer garden restaurant, private beach, indoor swimming pool with warm sea-water and outdoor childrens' one, sauna, congress and concert hall, pizzeria, beer cellar, bowling hall, hairdresser's and barbershops, first-aid station, numerous boutiques, disco club. Central heating and air conditioning.

Capacities will be reserved from 19. to 23. September 2003.

Daily room prices with full pansion for one person in Hotel "Plaža" are:

- Single room 30,- EUR
- Double room 25,- EUR

Accommodation reservation has to be made by tourist agency "SKY PASS" - Belgrad (tel: 011/324-8437, 011/322-8640, 011/334-5600; fax: 011/324-8891 and e-mail: skypass@eunet.yu).

Honour diner and picnics:

Organizers are planned for participants of Conference:

- Honour diner with musical programme
 - Price for participants situated in hotel "Plaža" by person is 15,- EUR
 - Price for participants not situated in hotel "Plaža" by person is 20,- EUR
- Picnic to:
 - Kotor (by bus) 8,- EUR
 - Peraške otoke (by boat) 10,- EUR

Sale of tickets for honour diner and picnics you can do by tourist agency "SKY PASS" – Belgrade.

Currency

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Sve sobe su sa balkonom i pogledom na more, kupatilom, telefonom i radiom. Svi apartmani su opremljeni kolor TV-om. Hotel ima letrnju baštu, sopstvenu plažu, zatvoreni bazen sa toplom vodom, otvoreni bazen za decu, saunu, kongresnu i koncertnu dvoranu, piceriju, pivnicu, kuglanu, frizerski salon, ambulantu, više butik, diskoteku. Opremljen je sistemom klimatizacije.

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COMPUTER AIDED DESIGN OF A WIND TURBINE BLADE

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Summary: In this paper, numerical algorithm developed for calculation of the mean HAWT (horizontal-axis wind turbine) dimensions is presented. Mathematical model consists of two parts. The first part includes calculation of the impeller mean dimensions, while the second part involves the blade pitch angles design. Based on the mathematical model, software is developed and applied for calculation and design of the 5 kW wind turbine blade. With results obtained, 3D model of wind turbine blade is modeled by using CATIA Wireframe and Surface Design as well as Part Design Modules and Excel software.

Keywords: Horizontal-axis wind turbine, Method of lifting surfaces, Blade design, CAD

1. INTRODUCTION

Wind is a significant and valuable renewable energy resource. It is the world's fastest growing energy source that can make an important contribution to future clean, sustainable and diversified electricity supplies. Unlike other sources of energy, wind does not pollute the atmosphere and does not create any hazardous waste. Wind power technology worth €5.8 billion was installed throughout the EU in 2002 that correspond to 5.871 MW of new power capacity, i.e., 31 % increase over previous year. Today wind energy projects across Europe produce around 24.000 MW, enough electricity to meet the domestic needs of 5 million people [1].

Wind energy potential in Serbia is valuable [2] but there is no evidence of significantly installed wind capacity so far. Because of that as well as of new Energy Law in Serbia, research and development of small wind turbine, rated power 5-10 kW, may be very attractive, particularly for domestic market. Also, experiences in design, production and exploitation of small wind capacities are very important in the process of the development of larger and more efficiency wind turbines.

Efficiency of wind turbine is relatively low and a theoretical maximum (that is $16/27=0.593$) exists denoted by the Betz limit [3]. Modern large wind turbines operate close to this limit, with efficiency up to 0.5 and are therefore optimized. Due to fact that the cost of small turbines per unit of power output is often much higher than for large machines, special attention should be paid on design of the wind turbine blades. Blades are in dynamic interaction with the air, transform the kinetic energy of wind into the mechanical energy of the rotating shaft and have the greatest influence on the overall turbine efficiency. In the literature, there are different approaches and mathematical models for the wind turbine blade design and most of them are based on the one-dimensional theory [4]. Also, optimization of the geometrical parameters of the wind turbine blade can be achieved by using advance numerical methods [5], [6], [7] and powerful computational resources.

Aim of this paper is to present simple and reliable numerical algorithm developed for geometrical modeling of a small wind turbine impeller. Our goal was, also, speeding up and automation of the impeller design process through usage of the Computer-Aided-Design tools. These objectives were obtained by using Dassault Systemes CATIA high-end CAD software in conjunction with Microsoft Excel spreadsheet calculator.

2. MATHEMATICAL MODEL

Mathematical model for wind turbine aerodynamics blade design consists of two segments. First part includes the algorithm for calculation of the main dimension of the wind turbine impeller. It is based on expression for power of moving air that flows through cross section A:

$$P_0 = \frac{1}{2} \rho c_0^3 A, \quad (1)$$

where ρ denotes air density and c_0 is wind speed. If P is the output power of the wind turbine, then:

$$P = P_0 \eta \eta_m = c_p P_0. \quad (2)$$

In equation (2), c_p is the power coefficient that is to be interpreted as ratio of the actual power produced to the available power of the wind. Sometimes c_p can be treated as an efficiency when comparing turbines of the same type. For the small horizontal axis wind turbine maximum values of the power coefficient are 0.4-0.45 [8]. Based on the wind turbine rated power, the wind speed and the chosen power coefficient it is possible to calculate the impeller outer diameter ($D_2 = 2R_2$) and the corresponding hub diameter. The rotational speed of the impeller can be written as:

$$n = \frac{30 \lambda c_0}{R_2 \pi} \quad (3)$$

where λ is the tip speed ratio (the tip speed to the wind speed). Usually, for the small wind turbine with three blades, the tip speed ratio lies between 7 and 10 when the turbine is performing optimally [9].

Main dimensions and rotational speed of the impeller as well as rated power of wind turbine are the input values for the second part of the mathematical model for wind turbine aerodynamic design. This module is developed for geometrical design of the blade, i.e., radial distribution of the blade chords and twist angles (sometimes termed the pitch angles). First step in this procedure is choosing appropriate aerodynamic blade profile. We have selected S809 airfoil (Appendix A – Table A-1) that is developed for design of small and medium wind turbine [10]. To enable optimal radial airfoil setting in order to achieve projected velocities triangles, method of lifting surfaces is used [11]. The blades of the impeller are divided into a number of blade elements in the radial direction. Row of blade elements can be projected in plane and then we have cascade of blade elements. One of cascades is shown on figure 1. There are two fundamental assumptions for cascade flow: a) the flow in each cascade is independent of that in other cascades and b) the force acting on each blade element are the same as those on an aerofoil of the same section, angle of attack and velocity.

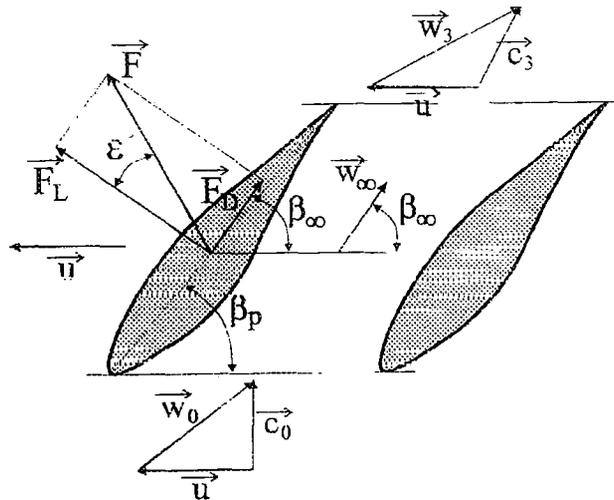


Figure 1 Velocity triangles and forces acting on blade elements in a moving cascade

Notations in Figure 1 are as follow:

- \vec{c}_0 - wind speed upwind of the cascade
- \vec{c}_3 - wind speed downwind of the cascade
- \vec{u} - cascade rotational velocity

- \vec{w}_0, \vec{w}_3 - upwind and downwind relative velocities
- \vec{w}_∞ - average relative velocity $(\vec{w}_0 + \vec{w}_3)/2$
- β_∞ - angle of average relative velocity vector
- \vec{F}_L, \vec{F}_D - lift and drag

Following the idea of method of lifting surfaces, blade is divided into a number of cascades in radial direction and then in each of them twist angle as the angle between the plane of rotation of the blade and element's chord line can be found from next equation:

$$\beta_p(r) = \beta_\infty(r) - \alpha(r) \quad (4)$$

where α is the angle of attack, which is something called the angle of incidence (angle between the average relative velocity and element's chord line). Using method of lifting surfaces, one can obtain next equation:

$$C_L \cdot \left(\frac{l}{t}\right) = \frac{2Y_{th} c_0 \cos \varepsilon}{w_\infty^2 u \sin(\beta_\infty - \varepsilon)} \quad (5)$$

where Y_{th} is the effective wind turbine work that can be obtained by using the Euler equation for the turbomachinery [11]. The value of the angle ε can be assumed in the first approximation and right hand side of the equation (2) will be known. If one assumes the radial distribution of the function (l/t) , where t - is cascade step and l - is blade element's chord, yields:

$$C_L(r) = \left(\frac{t}{l}(r)\right) \cdot RHS(r) \quad (6)$$

where $RHS(r)$ denotes right hand side of equation (2) and C_L is the lift coefficient. Based on the airfoil data (Appendix A – Table A-2) and equation (3), angle of attack (α) as well as drag coefficient (C_D) are to be calculated. Using next relation:

$$\varepsilon = \arctg \frac{F_D}{F_L} = \arctg \frac{C_D}{C_L} \quad (6)$$

guessed value for ε can be checked and if certain tolerance ($|\varepsilon_{new} - \varepsilon_{old}| \leq 10^{-5}$) is not satisfied procedure is to be repeated from the step defined by the equation (2). Iterative procedure is finished when convergence is reached at each radial locations and then twist and chord distributions for the blade is completely defined.

3. 3D MODEL OF THE WIND TURBINE BLADE

Using presented mathematical model, software for wind turbine aerodynamic design is developed. This numerical algorithm is applied for the geometrical design of 5 kW horizontal axis wind turbine with three blades. For that case, twist and chord radial distributions of the blade is shown in the Figure 2.

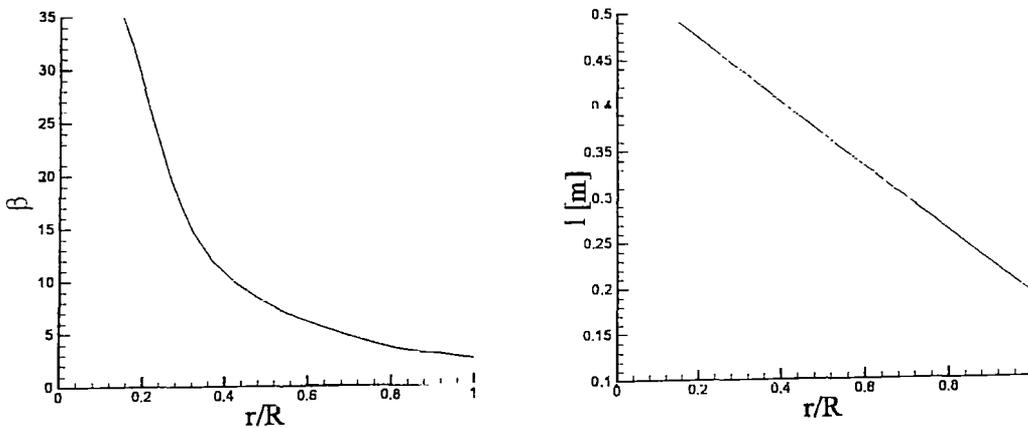


Figure 2 Twist and chord distributions of the blade

Based on calculation module and twist and chord distributions obtained, nearly 2.000 coordinate points was available for design of the 3D blade model. Geometrical shape of the blade is defined by two set of points. First set of points corresponds to pressure side and second one corresponds to the suction side of the blade. Those points were then used to build Excel spreadsheet in the form shown in the Figure 3.

Row	Column A	Column B	Column C	Column D	Column E	Column F	Column G	Column H	Column I
2	StartLoft	StartCurve	-78.527	-49.788	522.128				
3			-79.334	-39.139	522.006				
4			-78.997	-33.417	522.057				
5			-77.499	-25.62	522.281				
6			-74.824	-19.519	522.571				
7			-7.10E+01	-11.548	523.207				
8			-66.001	-3.343	523.859				
9			-59.916	5.268	524.585				
10			-52.778	14.032	525.386				
11			-44.64	22.839	526.11				
12			-36.579	31.546	526.8				
13			-2.57E+01	40.016	527.376				
14			-19	48.115	527.787				
15			-3.658	55.67	527.967				
16			8.279	62.515	527.935				
17			20.804	68.271	527.59				
18			34.909	72.505	526.884				
19			48.95	75.022	525.726				
20			6.42E+01	75.253	524.08				
21			79.549	82.526	521.973				
22			94.577	86.824	519.46				
23			108.997	89.096	516.627				
24			122.559	92.257	513.579				
31	End								

Figure 3 Excel spreadsheet with wind turbine blade coordinates

The Excel document, shown in the Figure 3, contains instructions, such as: a) StartLoft and EndLoft, StartCurve and EndCurve between which other instructions or numerical data are given; b) numerical data that are point space coordinates X, Y, Z respectively from the left to the right; and c) a final End instruction. In our case, the suction and the pressure sides of the blade are represented by lofts that were created based on 30 curves each. The every curve passes through 35 points. The elements will be created from top to bottom, i.e. the 35 points of the first curve will be created, then the curve itself, then the points making up the second curve and the latter itself, and so forth. When spreadsheet is ready, one can load Excel macro for creating CATIA elements from an external file that is shown in Figure 4. At the same time, the CATIA Wireframe and Surface Design workbench needs to be loaded, provided a CATIA session is running in order to design a CATPart document.

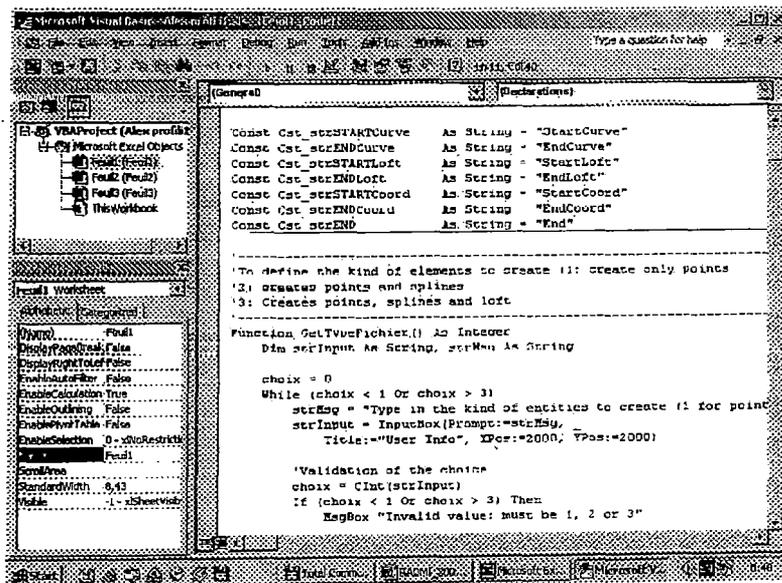


Figure 4 Excel macro for creating CATIA elements from an external file

In Figure 5, CATIA 3D wireframe as well as solid model of the wind turbine blade is presented.

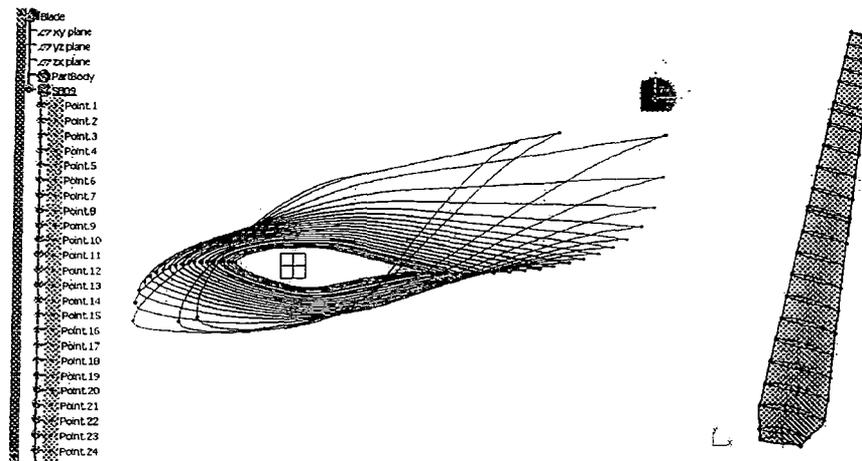


Figure 5. CATIA 3D Wireframe and Solid model of the wind turbine blade

4. CONCLUSION

In this paper, numerical model for aerodynamic modeling of a wind turbine blade is presented. By using one-dimensional theory as well as method of the lifting surfaces, relatively simple but efficient model is developed and applied for calculation of the main impeller parameters and chord and twist distributions of the small 5 kW wind turbine blade. In order to speeding up the process of blade design, CATIA Wireframe and Surface workbench is used in conjunction with Excel software.

Presented approach is dedicated to small wind turbines. For the design of the large wind power plants, investments are significantly higher and special attention is to be paid for the blade optimization in the aerodynamics as well as in the structural sense. Accordingly, installment of the presented research is initialized in the direction of wind turbine performance prediction. With developed numerical model and future reliable numerical algorithm for performance prediction, wind turbine impeller can be analyzed, modified and optimized to be high efficient and cheap for the production.

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APPENDIX A

Table A-1. Profile Coordinates for the S809 Airfoil

x/c	y/c	x/c	y/c
0.000000	0.000000	0.000000	0.000000
0.001400	-0.004980	0.000370	0.002750
0.009330	-0.012720	0.005750	0.011660
0.023210	-0.021620	0.016260	0.021330
0.042230	-0.031440	0.031580	0.031360
0.065790	-0.041990	0.051470	0.041430
0.093250	-0.053010	0.075680	0.051320
0.123970	-0.064080	0.103900	0.060820
0.157520	-0.074670	0.135800	0.069720
0.193620	-0.084470	0.171030	0.077860
0.231750	-0.093260	0.209200	0.085050
0.271290	-0.100600	0.249870	0.091130
0.311880	-0.105890	0.292590	0.095940
0.353280	-0.108660	0.336890	0.099330
0.395410	-0.108420	0.382230	0.101090
0.438320	-0.104840	0.428090	0.101010
0.482340	-0.097560	0.473840	0.098430
0.528370	-0.086970	0.520050	0.092370
0.576630	-0.074420	0.568010	0.083560
0.626490	-0.061120	0.617470	0.073790
0.677100	-0.047920	0.667180	0.064030
0.727520	-0.035580	0.716060	0.054620
0.776680	-0.024660	0.763140	0.045780
0.823480	-0.015590	0.807560	0.037610
0.866770	-0.008590	0.848540	0.030170
0.905450	-0.003700	0.885370	0.023350
0.938520	-0.000750	0.917630	0.016940
0.965090	0.000540	0.945230	0.011010
0.984460	0.000650	0.967990	0.006000
0.996120	0.000240	0.985280	0.002450
1.000000	0.000000	0.996230	0.000540
0.000000	0.000000	1.000000	0.000000


 Lower Surface


 Upper Surface

Table A-2. Aerodynamic Coefficients for S809 Airfoil

$\alpha(^{\circ})$	C_L	C_D	C_M
-180.00	.000	0.1748	0.0000
-170.00	.230	0.2116	0.4000
-160.00	.460	0.3172	0.1018
-150.00	.494	0.4784	0.1333
-140.00	.510	0.6743	0.1727
-130.00	.486	0.8799	0.2132
-120.00	.415	1.0684	0.2498
-110.00	.302	1.2148	0.2779
-100.00	.159	1.2989	0.2933
-90.00	.000	1.308	0.2936
-80.00	-.159	1.2989	0.2933
-70.00	-.302	1.2148	0.2779
-60.00	-.415	1.0684	0.2498
-50.00	-.486	0.8799	0.2132
-40.00	-.510	0.6743	0.1727
-30.00	-.494	0.4784	0.1333
-20.10	-.560	0.3027	0.0612
-18.10	-.670	0.3069	0.0904
-16.10	-.790	0.1928	0.0293
-14.20	-.840	0.0898	-0.0090
-12.20	-.700	0.0553	-0.0045
-10.10	-.630	0.039	-0.0044
-8.20	-.560	0.0233	-0.0051
-6.10	-.640	0.0131	0.0018
-4.10	-.420	0.0134	-0.0216
-2.10	-.210	0.0119	-0.0282
.10	.050	0.0122	-0.0346
2.00	.300	0.0116	-0.0405
4.10	.540	0.0144	-0.0455
6.20	.790	0.0146	-0.0507
8.10	.900	0.0162	-0.0404
10.20	.930	0.0274	-0.0321
11.30	.920	0.0303	-0.0281
12.10	.950	0.0369	-0.0284
13.20	.990	0.0509	-0.0322
14.20	1.010	0.0618	-0.0361
15.30	1.020	0.0776	-0.0363
16.30	1.000	0.0917	-0.0393
17.10	.940	0.0994	-0.0398
18.10	.850	0.2306	-0.0983
19.10	.700	0.3142	-0.1242
20.10	.660	0.3186	-0.1155
30.00	.705	0.4784	-0.2459
40.00	.729	0.6743	-0.2813
50.00	.694	0.8799	-0.3134
60.00	.593	1.0684	-0.3388
70.00	.432	1.2148	-0.3557
80.00	.227	1.2989	-0.3630
90.00	.000	1.308	-0.3604
100.00	-.159	1.2989	-0.3600
110.00	-.302	1.2148	-0.3446
120.00	-.415	1.0684	-0.3166
130.00	-.486	0.8799	-0.2800
140.00	-.510	0.6743	-0.2394
150.00	-.494	0.4784	-0.2001
160.00	-.460	0.3172	-0.1685
170.00	-.230	0.2116	-0.5000
180.00	.000	0.1748	0.0000