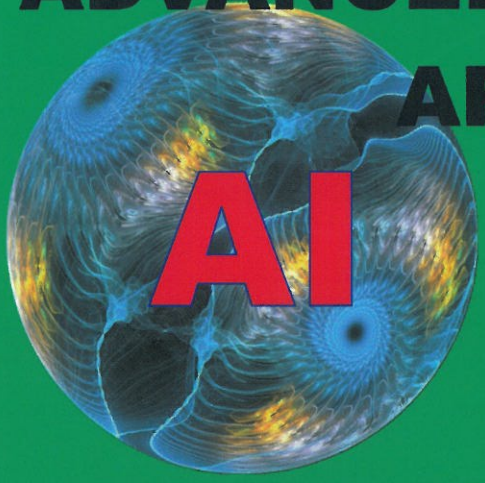
PROCEEDINGS

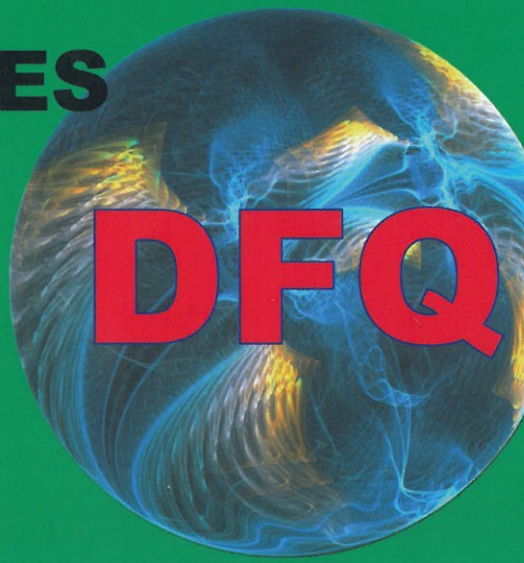
Edited by

Professor Dr. Vidosav D. Majstorovic

The Seventh International Working Conference

TOTAL QUALITY MANAGEMENT-ADVANCED AND INTELLIGENT APPROACHES





1st - 5th June, 2015
Belgrade, SERBIA

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PROCEEDINGS

Edited by
Professor Dr. Vidosav D. MAJSTOROVIĆ

The 8th International Working Conference

TOTAL QUALITY MANAGEMENT – ADVANCED AND INTELLIGENT APPROACHES

1st – 5th June 2015
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Preface from the Conference President

Quality issues become particularly important, because they acquire new dimensions and often present milestone for survival of an organisation on the global market. Today, engineering-technical dimensions of quality are implied, while business-managing aspects are developing, improving and increasingly applying. In parallel to this, sustainable development issues (ISO 9001:2015 and also 9004:2016), limited resources (energy (ISO 50001:2011) and row materials), climate changes and global financial crisis further emhpasize the need for quality management advancement.

The 8th IWC TQM Conference, Belgrade 2015 has a basic objective to offer the answers, from scientific-research point of view, on challenging issues regarding the progress of quality management, manufacturing metrology and enabling technology based on micro/nano and ICT technologies. From the other side, equally important aspect of this Conference is the application of a new QM models and experiences related to this.

An especially important aspect of the Conference is its contribution to global integrations our country in the scientific-research domain, as well as in business-industrial activities. It has become the world-known scientific-business forum for the exchange of knowledge and ideas and discussion about directions of future quality management concepts, through open-discussions, on a biannual basis.

This conference has a long tradition. A large number of scientists, professors, researchers and organizations have contributed immeasurably to its development since 2001. the present. All of them are very proud, and particularly to:

Professors who have held "Opening Plenary Lecture" at the Conference, as well as the holders of awards for his personal contribution to the development of world theory and practice of QM and manufacturing metrology and also TQM Conference Honorary Chairs, from 2001 to 2015:

Prof. Dr. Günter ARNDT, University of Wollongong, Australia (2001); Prof. Dr. Laszlo MONOSTORI, Hungarian Academy of Science, Budapest, Hungary (2003); Prof. Dr. Gunnar H. SOHLENIUS, The Royal Institute of Technology, Stockholm, Sweden (2005); Prof. Dr. Herbert OSANNA, TU Vienna, Austria (2007); Prof. Dr. Ton van der WIELE, Erasmus University Rottedam, The Netherlands (2009); Prof. Dr. Francesco JOVANE, Politecnico di Milano, Italy (2011); Prof. Dr. Albert WECKENMANN, University Erlangen-Nuremberg, Germany (2013); Prof. Dr. Numan DURAKBASA, TU Vienna, Austria (2015).

Award for the best paper on PhD student from their PhD thesis, from 2007 to 2015.

The Special Session – Young PhD researches, has been introduced at 2007, where PhD students present their research. The Award winners from 2007 to 2015 were:

The winner in 2007, was:

Laura Catellani, PhD student from Dipartimento di Meccanica – Politecnico di Milano, Milano, Italy, for the paper „*Detecting out-of-control samples in customers' satisfaction surveys analysis: the effect of coding the categories of the ordinal scale*".

The laureate for 2009, was:

Michael Giebel, PhD student from University of Kassel, Germany, for the paper „*Value Added by Quality Management – Developing a Model Describing the Mechanisms and a Process Approach for Introduction*".

The winner in 2011, was:

Maria Stella Chiacchio, PhD student from Molecular Design Department, Consiglio Nazionale delle Ricerche, Rome, Italy, for the paper „*Early Impact Assessment For Sustainable Development Of Enabling Technologies*".

The laureate for 2013, was:

Malte Schröder, PhD student from Chair of Metrology and Quality Management, Laboratory for Machine Tools and Production Engineering WZL, Aachen, Germany, for the paper „*Strategies For The Design And Implementation Of Quality Control Loops To Reach Stable Business Processes*".

The winner in 2015, was:

Ina Heine, PhD student from Laboratory for Machine Tools and Production Engineering, RWTH Aachen University, Aachen, Germany, for the paper *"Critical Incidents of Quality Orientation in Lower and Middle Management*".

Professors and researchers from abroad who gave "personal" contribution on the development of the TQM Conference from 2001 to 2015:

Prof. Dr. I. Angeli (Cypres), Prof. Dr. G. Barouch (France), Prof. Dr. M. Bobrek (BiH), Prof. Dr. C. Bouzakis (Greece), Prof. D. Brissaud (France), Prof. Dr. A. Brun (Italy), Dr. L. Cagnazzo (Italy), Prof. Dr. P. Castka (New Zeland), Dr. J. Caldeira (Portugal), (Miss) Dr. Eng. Laura Catellani (Italy), (Mrs) Sonja Čerepnalkovska (FRY Macedonia), Dr. M. Debenham (United Kingdom), Prof. Dr. N. Dragulanescu (Romania), Prof. Dr. A. El Kashlan (Egypt), Prof. Dr. M. Frota (Brasil), (Mrs) Prof. Dr. Aida Habul (BiH), (Mrs) Prof. Dr. Dragana Grubišić (Hr), Prof. Dr. R. Isaksson (S), Dr. L. Jalba (Ro), Prof. Dr. A. Jesus (Br), Prof. Dr. J. Jedrzejewski (Poland), Prof. Dr. S. Karapetrovic (Canada), Prof. Dr. P. Kuhlang (Austria), (Mrs) Prof. Dr. Micaela Martínez Costa (Spain), (Mrs) Dr. Iveta Mezinska (Litvania), Prof. Dr. Peter Monka (Slovakia), (Mrs) Prof. Dr. Katarina Monkova (Slovakia), Prof. Dr. D. Mourtzis (Gr), Prof. Dr. S. Naruo (Japan), (Mrs) Dr Boyka Nenkova (Bulgaria), Prof. Dr. J. Ni (USA), (Mrs) Dr. Liliana Nitu (Romania), (Mrs) Dr Augusta Paci (Italy), Dr. R. Paskevicius (Letonia), Prof. Dr. T. Pfeifer (Germany), (Mrs) Prof. Dr. Lidiya Petrova-Galabova (Bulgaria), Dr. S. Rosu (Romania), Prof. Dr. M. Saleem (Pakistan), Prof. Dr. R. Schmitt (G), Dr. I. Sheps (Israel), Prof. Dr. M. Soković (Slovenia), Prof. Dr. T. Sorin (Romania), (Mrs) Prof. Dr. Dana Stancekova (Slovakia), Prof. Dr. H. VanBrussel (Belgium), Prof. Dr. M. Taisch (Italy), (Mrs) Prof. Dr. Kristina Zgodadova (Slovakia), Prof. Dr. N.M. Vaxevanidis (Greece).

Professors from the Serbia that gave "personal" contribution on the development of the TQM Conference from 2001 to 2015:

Prof. Dr. P. Bojanić, Prof. Dr. B. Kamberović, Prof. Dr. B. Đedović, Prof. Dr. D. Đorđević, Prof. Dr. M. Hadžistević, (Mrs) Prof. Dr. Valentina Marinkovic, Prof. Dr. V. Milačić, Prof. Dr. Z. Miljkovic, Prof. Dr. V. Moračanin, (Mrs) Prof. Dr. Snežana Pejčić-Tarle, Prof. Dr. P. Popović, (Miss) Prof. Dr. Tatjana Sibalija, (Mrs) Prof. Dr. Vesna Spasojević-Brkić, Prof. Dr. J Stanic, Prof. Dr. V. Radlovački, Prof. Dr. M. Trajanovic, (Mrs) Prof. Dr. Ljiljana Tasić, Prof. Dr. D. Stanivuković, Prof. Dr. V. Stojiljković, (Mrs) Prof. Dr. Gordana Ušćebrka, Prof. Dr. D. Ćoćkalo.

National Honorary Committee from 2001 to 2015.

Prof. Dr. N. Hajdin, Former President of Serbian Academy Science and Arts; Prof. Dr. M. Milovančević, Dean of Mechanical Engineering Faculty, Belgrade; Prof. Dr. R. Mitrović, Former State Secretary for Sciences of Technology; Prof. Dr. M. Nedeljković, Mechanical Engineering Faculty, Belgrade; Prof. Dr. A. Sedmak, Director of Innovation Centre, Mechanical Engineering Faculty, Prof. Dr. V. Lučanin, Vice-Dean for Research, Mechanical Engineering Faculty, Prof. Dr. B. Babić, Chief of Production Engineering Department, Mechanical Engineering Faculty, Prof. Dr. Lj. Tanovic, Production Engineering Department, Mechanical Engineering Faculty.

National / International Sponsors Honorary Committee from 2001 to 2015.

Prof. Dr. A. Weckenmann, CIRP, Paris; Prof. Dr. D. Kiritsis, IFIP, Laxenburg Austria; Prof. Dr. Y. Takaya, IMEKO, Laxenburg Austria; Prof. Dr. M. Taisch, IMS, Zurich, Swiss; Gainluca Mule, EFQM, Brussels, Begium; Prof. Dr. A. Douglas, Emerald Publishing, UK; Milena Matijašević, Carlsberg Srbija doo, Belgrade; Jovana Mladenović, Carlsberg Srbija doo, Belgrade; MSc. Vida Živković, National Institute for Metrology, Belgrade; P. Jakovljević, Metalac Holding, Gornji Milanovac; D. Lazić, Metalac Holding, Gornji Milanovac; M. Milatović, Energoprojekt Holding, Belgrade; B. Sladić, Energoprojekt oprema, Belgrade; Dr. P. Popović, Institute for Nuclear Scince "Vinča" – Department for certification, Belgrade, Dr. L. Jalba, Microelectronica S.A., Bucharest, Romania; M. Luković, Company "Sloboda", Čačak; S. Srećković, Informatika, Beograd; G. Ušendić, Gemont, Belgrade; B. Erčević, IVA 28, Obrenovac, D. Korčak, Abela Pharm, Belgrade.

International organizations that have supported the development of the TQM Conference, from 2001 to 2015.

The International Academy for Production Engineering (CIRP), Paris, France.
Japanese Union of Scientist and Engineers (**JUSE**); Tokyo; Japan.
European Organization for Quality (**EOQ**); Brussels; Belgium.
European Foundation for Quality Management (**EFQM**); Brussels; Belgium.
American Society for Quality (**ASQ**); Milwaukee; USA
International Federation for Information Processing (**IFIP**); Laxenburg; Austria.
WG 5.7 Integration and Production Management
International Measurement Confederation (**IMEKO**); Budapest; Hungary.
TC 14 Measurement of Geometrical Quantities.
International Federation of Automatic Control (**IFAC**); Laxenburg; Austria.
TC 5. 1 Manufacturing Plant Control.
TC 5.2 Manufacturing Modelling for Management and Control.
TC 5.3 Enterprise Integration and Networking.
Australian Organization for Quality Inc. (**AQA**), Blackwood, Australia
Asia Pacific Quality Organization (**APQO**), Rizal, Philippines.

Note: *Ministry of Education, Science and Technology the Republic of Serbia supports this Conference since 2001.*

We all thank them immensely for the growth and development of TQM Conference.

From the Fourth IWC TQM Conference, Belgrade 2007, two novelties have been introduces: (i) *The award for an individual for significant personal contribution to the Conference development, and (ii) award for the best paper of a PhD student from their PhD thesis.*

In 2007. the first winners, were Prof. Dr. Herbert Osanna, TU Vienna, Austria, the honorary president of the Conference. He is one of the Conference founders; at each conference he presented the introduction paper accepted from the audience with the utmost attention. (ii) *The award for a young researcher, for his/her doctoral thesis research.* From this reason, the Special Session – Young researches, has been introduced at 2007 and is awarded to a deserving, PhD student who presented his/her researches at the Conference. This award was won by Laura Catellani, Dipartimento di Meccanica – Politecnico di Milano, Milano, Italy, for the paper *„Detecting out-of-control samples in customers' satisfaction surveys analysis: the effect of coding the categories of the ordinal scale".*

The laureates for 2009, have been: (i) Prof. Dr. Ton van der Wiele, Rotterdam School of Management, Erasmus University, Rotterdam, The Netherlands. Prof. Wiele was one of the honorary presidents of the Conference, with regular participation since 2003. He is world well-known scientific in QM domain, who has presented introduction papers at each conference from its foundation, showing the way toward QM theory progress, and (ii) the award for the best young researcher belongs to Michael Giebel, PhD student from University of Kassel, Germany, for the paper *„Value Added by Quality Management – Developing a Model Describing the Mechanisms and a Process Approach for Introduction".*

The winners in 2011, have been: (i) Prof. Dr. Francesco Jovane, Politecnico di Milano, Manufuture Vice-president, Italy. Prof. Jovane was one of the honorary presidents of the Conference, with regular participation since 2004. He is worldwide known scientist in Manufacturing engineering and "father" of the EU Manu*future* Program / Platform, he has presented introduction papers at conference before, showing the way toward Manufacturing theory and practices progress, (ii) the award for the best young researcher belongs to Maria Stella Chiacchio, Molecular Design Department, Consiglio Nazionale delle Ricerche,

Rome, Italy. for the *paper „Early Impact Assessment For Sustainable Development Of Enabling Technologies".*

The laureates for 2013, have been: (i) Prof. Dr. A. Weckenmann, Friedrich-Alexander-University Erlangen-Nuremberg, Chair Quality Management and Manufacturing Metrology, Erlangen, Germany. Prof. Weckenmann was one of the honorary presidents of the Conference, with regular participation since 2001. He is a world renouned scientist in Manufacturing metrology and Quality management. He is also member of CIRP and former President of CIRP STC for Metrology, and also a member of IMEKO and President of TC 14 for Engineering Metrology, (ii) the award for the best young researcher belongs to Malte Schröder, Chair of Metrology and Quality Management, Laboratory for Machine Tools and Production Engineering WZL, Aachen, Germany; for the paper *„Strategies For The Design And Implementation Of Quality Control Loops To Reach Stable Business Processes".*

With the greatest please, I would like to introduce **the winner for 2015:**

The laureates for 2015, are: (i) **Prof. Dr. Numan Durakbasa**, TU Vienna, Austria, the honorary president of the Conference, with regular participation since 2007, who has presented introduction papers at each conference from its foundation, showing the way toward QM and Manufacturing Metrology theory and practice progress. He is a world renouned scientist in Manufacturing metrology and Quality management and is also a member of IMEKO Board of TC 14 for Engineering Metrology, (ii) this year, the award for the best young researcher belongs to **Ina Heine**, PhD student from Laboratory for Machine Tools and Production Engineering, RWTH Aachen University, Aachen, Germany, for the paper *"Critical Incidents of Quality Orientation in Lower and Middle Management*".

The Conference 2015 includes various scientific-expert contents that add a specific dimension, which could not be found in other conferences from the technical fields held in Serbia, as follows:

Session1 - Workshop 1 / Round Table Disscussion 1: Topics: Critical Incident Technique /Overview of the Industry-University Cooperative Research Center (I-UCRC) on Intelligent Maintenance Systems at the University of Texas at Austin / Writing for Publication in Journal from SCI lists.
Session 2: The Opening Ceremony and Plenary Presentation
Session 3 - Opening Plenary Session: Advanced Quality – World - wide Approaches (State of the Art)
Session 4 – Young PhD researchers
Session 5 - Quality management and advance regulations
Session 6 - TQM and Knowledge Management
Session 7 - Continuous improvement
Session 8 – The Fourth Special Conference "Manufuture in Serbia 2015" / Advanced Manufacturing Technology.
Session 9 – Advanced Quality Model – ISO 9001:2015
Session 10 – Special Conference / 6th Balkan Conference on Quality / 7th Balkan Quality Forum - The Balkan As A Region Of Quality
Session 11 - Quality management in service sectors
Session 12 - Workshop 2 - Holistic Approaches to Quality Improvement in Manufacturing
Session 13 - Advanced approaches of quality and metrology
Session 14 - Session – QM and enable technologies
Session 15 - Quality management in education and education for Quality
Session 16 - Quality engineering techniques application
Session 17 – Hall 211 (Second floor) - Closing Plenary Session: TQM & QM New Dimensions

The greatest value of the Conference refers to the **authors/participants** from **five continents and 36 countries.** Their high competence and high-quality level of papers have given the crucial contribution to the Conference.

The special gratitude is owed refers to the **Honorary Presidents of the Conference, the members of International Program Committee and the Presidents of the Sessions**, for their personal contribution to the success of the Conference.

A large number of organizations, institutions and individuals contributed to the preparation of the Conference, for which I am especially grateful. Some of them have been supporting us continuously, so they deserve special acknowledgement: *Serbian Academy of Science and Arts, and its Former President Prof. Dr. Nikola Hajdin, CIRP, Paris, France. JUSE (Japanese Union of Scientist and Engineers), Tokyo, Japan, Dr. Isaac Sheps, Senior Executive Advisor to Carlsberg Group, Israel, and Dr. Liviu Jalba, General Manager, Company "Mikroelectronica", Bucharest, Romania .*

A special acknowledgment is extended to the **main patron – Carlsberg Serbia**, who, by its contribution, enables a high level of arrangement and organisation of the Conference, **since 2007.** Carlsberg Serbia is also proven as an exceptional host of technical support of the Conference, which added a new dimension to the whole concept. Our gratitude deserves the other sponsors, because without their help this Conference could not be successfully organised.

The Ministry of Education, Science and Technological Development of Republic of Serbia has supported the Conference, since 2001, and I would like to express our sincere gratefulness.

Belgrade, April 20th 2015.

Prof. Dr. Vidosav D. Majstorović,

The President and Founder of TQM Conference

Acknowledgment

The Belgrade University, Mechanical Engineering Faculty, Production Engineering Department, Laboratory for Production Metrology and TQM, wishes to thank all authors, participants, institutions, associations, organizations and companies for their kind contributions and support in organizing the ***8th International Working Conference "TOTAL QUALITY MANAGEMENT – ADVANCED AND INTELLIGENT APPROACHES"***. This traditionally Conference will be held as a part of INTERNATIONAL QUALITY CONVENTION, Belgrade - 2015. This Conference will be held between 1st – 5th June, 2015 in Belgrade, Serbia.

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- IVA 28, Obrenovac,
- Institute "Kirilo Savić", Belgrade, Serbia,
- Institute "Lola", Belgrade, Serbia,
- Wiener Städtische osiguranje a.d.o. Belgrade, Serbia.

Conference Chair and Founder : *Prof. Dr. V. Majstorovic (Ser).*

Members: *Prof. Dr. I. Angeli (Cy), Prof. Dr. B. Ačko (Sl), Prof. Dr. I. Bacivarov (Ro), Prof. Dr. M. Bobrek (BiH), Prof. Dr. J, Barouch (F), Prof. Dr. A. Bernard (Fr), Prof. Dr. C. Bouzakis (Gr), Prof. D. Brissaud (F), Prof. Dr. A. Brun (I), Dr. L. Cagnazzo (I), Prof. Dr. P. Castka (NZ), Dr. J. Caldeira (Pl), (Miss) Dr. Eng. L. Catellani (I), Prof. Dr. E. Chlebus (Pl), Prof. Dr. K. Cho (K), Prof. Dr. G. Chryssolours (Gr), Prof. Dr. G. Constantin (Ro), Prof. Dr. P. Cunha (Po), Prof. Dr. L. DeChiffre (Dk), B. Dimitrijević (Ca), Dr A. Douglas (UK), Prof. Dr. N. Dragulanescu (Ro), Prof. Dr. J. Duflou (Be), Prof. Dr. D. Djurdjanovic (USA),), Prof. Dr. A. El Kashlan (Egypt), Prof. Dr. F. Fang (Ch), (Mrs) Prof. Dr. A. Fisher (Is), Prof. Dr. M. Frota (Br), A. Gentili (I), (Mrs) Prof. Dr. D. Grubišić (Hr), Prof. Dr. I. Inasaki (J), Dr. R. Isaksson (S), Dr. L. Jalba (Ro), Prof. Dr. A. Jesus (Br), Prof. Dr. J. Jedrzejewski (Pl), Prof. Dr. R. Jochem (D), Prof. Dr. Z. Katz (SA), Prof. Dr. F. Kimura (J), (Mrs) Prof. Dr. A. Kjellberg (S), Prof. Dr. P. Kopacek (At), Prof. Dr. J. P. Kruth (Be), Prof. Dr. A. Kusiak (USA), Prof. Dr. P. Kuhlang (At), Prof. Dr. S. Lu (USA), (Mrs) Prof. Dr. V. Marinkovic (Ser), Prof. Dr. G. Maropoulos (UK), (Mrs) Prof. Dr. A. Marcheva (Bu), (Mrs) I. Mezinska (Lv), Prof. Dr. V. Milačić (Ser), Prof. Dr. Z. Miljkovic (Ser), Prof. Dr. A. Molina (Mx), Prof. Dr. P. Molnar (H), Prof. Dr. G. Morel (F), Prof. Dr. D. Mourtzis (Gr), Prof. Dr. S. Naruo (J), Prof. Dr. J. Ni (USA), (Mrs) L. Nitu (Ro), (Mrs) Dr A. Paci (I), Prof. Dr. H. Panetto (Fr), Dr. R. Paskevicius (Lt), Dr. G. Pegs (UK), (Mrs) Prof. Dr. S. Pejčić-Tarle (Ser), Prof. Dr. C. Periera (Br), (Mrs) Prof. Dr. L. Petrova-Galabova (Bu), Dr. S. Rosu (Ro), Prof. Dr. R. Roy (UK), Dr. S. Ruprai (Au), Dr. I. Sheps (Is), Prof. Dr. W. Sihn (At), (Miss) Prof. Dr. T. Sibalija (Ser), Prof. Dr. M. Sphitalini (Is), Prof. Dr. M. Soković (Sl), Prof. Dr. V. Spasojević-Brkić (Ser), Prof. Dr. S. Takata (J), Prof. Dr. T. Sorin (Ro), Prof. Dr. M. Taisch (I), Prof. Dr. R. Teti (I), Prof. Dr. M. Trajanovic (Ser), Prof. Dr. R. Tuokko (Fi), Prof. Dr. K. Ueda (J), Prof. Dr. G. Zhang (Ch), Prof. Dr. S. Yamada (J), Prof. Dr. F. Vernadat (Fr), Prof. Dr. E. Westkaemper (G).*

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European Foundation for Quality Management (**EFQM**); Brussels; Belgium.
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International Federation for Information Processing (**IFIP**); Laxenburg; Austria.
WG 5.7 Integration and Production Management
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TC 14 Measurement of Geometrical Quantities
International Federation of Automatic Control (**IFAC**); Laxenburg; Austria.
TC 5. 1 Manufacturing Plant Control
TC 5.2 Manufacturing Modelling for Management and Control
TC 5.3 Enterprise Integration and Networking
Australian Organization for Quality Inc. (**AQA**), Blackwood, Australia
Asia Pacific Quality Organization (**APQO**), Rizal, Philippines

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Organized by

The University of Belgrade, Mechanical Engineering Faculty, Laboratory for Production Metrology and TQM, Belgrade, Serbia.

Technical organized by

United Association of Serbia for Quality (**UASQ**), Belgrade, Serbia.

CONFERENCE INFORMATION

DATE: 1st – 5th June, 2015.

VENUE: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade / Hall 211 (second flor), Hall CeNT (first floor), Hall 514 (5th floor), Hall 518 (5th floor), Cocktails / Refreshments: Club CeNT (first floor), Registration desk Club CeNT (first floor).

OFFICIAL LANGUAGE

The official language of the Conference is English.

WEB- SITE & E – MAIL

For further information please visit web-site: www.mas.bg.ac.rs or www.jusk.rs
E - mail: vidosav.majstorovic@sbb.rs or jusk@eunet.rs

IMPORTANT DATES

Early Registration:	Before May 15th, 2015.
Late Registration:	After May 15th, 2015.
Welcome Cocktail:	June 2nd , 2015.
Opening Session:	June 2nd, 2015.
Opening Cocktail:	June 1st, 2015.
Conference Dinner (informal):	June 2nd, 2015.
Excursion tour:	June 5th, 2015.
Workshop1 / RTD 1:	June 1st, 2015.
Worksgop 2	June 3rd, 2015.
Special Conferences:	June 3rd, 2015.
Closing Plenary Session:	June 4th, 2015.
Farewell Cocktail:	June 4th, 2015.

CONFERENCE (Registration Office)

Prof. Dr. Vidosav D. MAJSTOROVIĆ

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11020 Beograd, PF 35, SERBIA

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Web: www.mas.bg.ac.rs or www.jusk.rs

The 8th IWC TQM CONFERENCE PLAN

1st June, 2015 / Monday	***Place: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade***

16:00 – 18:00

Registration on reception desk (first floor – hall CeNT) in **Mechanical Engineering Faculty**, str. Kraljice Marije 16, Belgrade.

19.00 – Mechanical Engineering Faculty – Hall CeNT (first floor - str. Kraljice Marije 16, Belgrade).

TQM 2015 / Session1 - Workshop 1 / Round Table Disscussion 1: Chairman – Prof. Dr. Stanislav Karapetrovic, University of Alberta, Department of Mechanical Engineering, Edmonton, Canada.

Topics:

1. Critical Incident Technique, Dr. Jacqueline A. Douglas, *Liverpool John Moores University, UK.*

2. Overview of the Industry-University Cooperative Research Center (I-UCRC) on Intelligent Maintenance Systems at the University of Texas at Austin, Prof. Dr. Dragan Djurdjanovic, *Dept. of Mechanical Engineering, University of Texas at Austin, USA.*

3. Writing for Publication in Journal from SCI lists, Prof. Dr. Alexander Douglas, *Editor The TQM Journal, Emerald Group Publishing Ltd, Howard House, Wagon Lane, Bingley, BD16 1WA, UK.*

(**Note**: Please ask, as soon as possible jusk@eunet.rs for detailed information. Number of participants are limited).

20:30

Opening Cocktail - **Club CeNT** (first level), Mechanical Engineering Faculty, Belgrade.

Sponsored by Abela Farm doo, Belgrade, Serbia – Cockatil party

The 8th IWC TQM CONFERENCE PLAN

Date: 2nd June, 2015 / Tuesday	***Place: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade***

Registration desk: **08:00 – 16:30** Registration

Time	**Hall 211** (Second floor)	
10:00 - 11:00	*TQM 2015 / Session* ***2: The Opening Ceremony and Plenary Presentation*** Opening addresses Awards **Opening Plenary Presentation:** **DEVELOPMENT OF IMPROVED TECHNIQUES FOR NEW LEVELS OF MANUFACTURING PRECISION WITH THE MICRO- AND NANO-COMPONENTS**, **Prof. Dr. Numan M. Durakbasa**, *Interchangeable Manufacturing and Industrial Metrology, Institute for Production Engineering and Laser Technology, Vienna University of Technology, Vienna, Austria;*	
11:00 -11:30	**Welcome Cocktails - Club CeNT** (first level)	
11:30 -13:30	*TQM 2015 / Session* ***3: Opening Plenary Session – Advanced Quality – World-wide Approaches*** **- Hall 211** (second floor) - Mechanical Engineering Faculty, Belgrade. ***Introductions Plenary Presentations***	
13:30 -15:00	**Break**	
	Hall 211 (Second floor)	**Hall 518** (Fifth floor)
15:00 - 16:30	***TQM 2015* / Session 4** ***Young PhD researchers***	***TQM 2015* / Session 5** **Quality management and advance regulations**
16:30 -17:00	**Break**	
17:00 -18:30	***TQM 2015* / Session 6** ***TQM and Knowledge Management***	***TQM 2015* / Session 7** **Continuous improvement**

20:30 IWC TQM 2015 / **Conference Dinner (informal).**

The 8th IWC TQM CONFERENCE PLAN

Date: 3rd June, 2015 / Wednesday	***Place: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade***

Registration desk: **08:00 – 16:30** Registration / **CeNT** (first level)

Time	**Hall 211** (Second floor)	**Hall 518** (Fifth floor)
09:00-10:30	***TQM 2015* / Session 8** **Fourth Special Conference "Manufuture in Serbia 2015" - *Advanced Manufacturing Technology.***	***TQM 2015* / Session 9** **Advanced Quality Model – ISO 9001:2015**
10:30-11:00	**Break**	
11:00-13:00	***TQM 2015* / Session 10** **6th Balkan Conference on Quality / 7th Balkan Quality Forum - *THE BALKAN AS A REGION OF QUALITY***	***TQM 2015* / Session 11** **Quality management in service sectors**
13:00-15:00	**Break**	
15:00-16:30	***TQM 2015* / Session 12** **Workshop 2 - *Holistic Approaches to Quality Improvement in Manufacturing***	***TQM 2015* / Session 13** **Advanced approaches of quality and metrology**
16:30-17:00	**Break**	
17:00-18:30	***TQM 2015* / Session 14** **Quality management in education and education for Quality**	***TQM 2015* / Session 15** **QM and enable technologies**

The 8th IWC TQM CONFERENCE PLAN

Date: 4th June, 2015 / Thursday	***Place: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade***

Registration desk: **08:00 – 11:00** Registration

Time	**Hall 211** (Second floor)
09:00-10:30	***TQM 2015* / Session 16** **Quality engineering techniques application**
10:30-11:00	**Break**
11:00-13:00	***TQM 2015* / Session 17** ***Closing Plenary Session*: *TQM & QM - New Dimensions***
13:00-14:00	**Farewell Cocktails in Club CeNT** (first level)

***Date:* 5th June, 2015 / Friday**	***Place: Lola Institute, Belgrade.***
08.00-12:00	***TQM 2015* / Excursion tour – *Lola Inastitute* (www.li.rs).** For details please contact: jusk@eunet.rs, as soon as possible, because number of participants are limited (min 30, max 50). Host of excursion tour is Lola Institure, Belgrade.

The 8th IWC TQM CONFERENCE PROGRAM

1st June, 2015 / Monday	***Place: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade***

16:00 – 18:00

Registration on reception desk (first floor – hall CeNT) in **Mechanical Engineering Faculty**, str. Kraljice Marije 16, Belgrade.

19.00 – Mechanical Engineering Faculty – Hall CeNT (first floor - str. Kraljice Marije 16, Belgrade).

TQM 2015 / Session1 - Workshop 1 / Round Table Disscussion 1: Chairman – Prof. Dr. Stanislav Karapetrovic, University of Alberta, Department of Mechanical Engineering, Edmonton, Canada.

Topics:

1. Critical Incident Technique, Dr. Jacqueline A. Douglas, *Liverpool John Moores University, UK.*

2. Overview of the Industry-University Cooperative Research Center (I-UCRC) on Intelligent Maintenance Systems at the University of Texas at Austin, Prof. Dr. Dragan Djurdjanovic, *Dept. of Mechanical Engineering, University of Texas at Austin, USA.*

3. Writing for Publication in Journal from SCI lists, Prof. Dr. Alexander Douglas, *Editor The TQM Journal, Emerald Group Publishing Ltd, Howard House, Wagon Lane, Bingley, BD16 1WA, UK.*

(**Note**: Please ask, as soon as possible jusk@eunet.rs for detailed information. Number of participants are limited).

20:30

Opening Cocktail - **Club CeNT** (first level), Mechanical Engineering Faculty, Belgrade.

Sponsored by Abela Pharm doo, Belgrade, Serbia – Cockatil party

The 8th IWC TQM CONFERENCE PROGRAM

***Date:* 2nd June, 2015 / Tuesday**	***Place: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade***

Registration desk: **08:00 – 16:30** Registration

Time	**Hall 211** (Second floor)
10:00-11:00	***TQM 2015 / Session 2: The Opening Ceremony and Plenary Presentation*** • **Welcome and Opening addresses** • **Awards** • **Opening Plenary Presentation:** **DEVELOPMENT OF IMPROVED TECHNIQUES FOR NEW LEVELS OF MANUFACTURING PRECISION WITH THE MICRO- AND NANO-COMPONENTS**, **Prof. Dr. Numan M. Durakbasa**, *Interchangeable Manufacturing and Industrial Metrology, Institute for Production Engineering and Laser Technology, Vienna University of Technology, Vienna, Austria;*
11:00–11:30	***Welcome Cocktail (Hall CeNT)***
11:30-13:30	***TQM 2015 / Opening Plenary Session – Session 2: Advanced Quality – World-wide Approaches (State of the Art)*** **Chairmen Session:** **Prof. Dr. Numan M. Durakbasa**, *Interchangeable Manufacturing and Industrial Metrology, Institute for Production Engineering and Laser Technology, Vienna University of Technology, Vienna, Austria;* **Prof. Dr. Alexander Douglas**, *Editor The TQM Journal, Emerald Group Publishing Ltd, Howard House, Wagon Lane, Bingley, BD16 1WA, UK;* **Prof. Dr. Dimitris Mourtzis,** *Laboratory for Manufacturing Systems and Automation, Department of Mechanical Engineering and Aeronautics, University of Patras, Rio Patras, Greece.* **Prof. Dr. Jun Ni,** *College of Engineering, University of Michigan, Ann Arbor, MI 48109, USA.* **Prof. Dr. Stanislav Karapetrovic,** University of Alberta, Department of Mechanical Engineering, Edmonton, Canada. **Gianluca Mulé,** *EFQM, Brussels, Avenue des Olympiades 2, 1200, Brussels, Belgium;* **Prof. Dr. Dragan Djurdjanovic**, *Department of Mechanical Engineering, University of Texas, Austin, TX, USA.* **Dr. Isaac Sheps**, *Senior Executive Advisor to Carlsberg Group's CEO and the Excom, Israel;* **Prof. Dr. George Constantin**, *Machines and Manufacturing Systems Department, University "Politehnica" of Bucharest, Romania;* **Prof. Dr. Valentina Marinković,** *Belgrade University, Faculty of Pharmacy, Belgrade,Sebia;*

Keynote Speakers:

1. DRIVE OUT FEAR: DEMING'S TQM CULTURAL CHALLENGE, **Alexander Douglas** (1), **Jacqueline Douglas** (2), *(1)Editor The TQM Journal, Emerald Group Publishing Ltd, Howard House, Wagon Lane, Bingley, BD16 1WA, UK; (2) Senior Lecturer in Quality Management, Liverpool Business School, Liverpool John Moores University, Brownlow Hill, L3 1UG, UK.*
2. A NEW ERA OF WEB COLLABORATION: CLOUD COMPUTING AND ITS APPLICATIONS IN MANUFACTURING, **Dimitris Mourtzis*, Babis Schoinochoritis, Ekaterini Vlachou**, *Laboratory for Manufacturing Systems and Automation, Department of Mechanical Engineering and Aeronautics, University of Patras, 26500, Rio Patras, Greece.*
3. OUTLOOK ON FUTURE MANUFACTURING COMPETITIVENESS, **Prof. Dr. Jun Ni,** *College of Engineering, University of Michigan, Ann Arbor, USA.*
4. IMS WITH AUGSs: TEN YEARS LATER, **Prof. Dr. Stanislav Karapetrovic, Katarinu Selaković,** *University of Alberta, Department of Mechanical Engineering, Edmonton, Canada,* **Prof. Dr. Vesna Spasojević-Brkić,** *University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia.*
5. EFQM AND ITS BENEFITS, **Gianluca Mulé, Matt Fisher**, *EFQM, Brussels, Avenue des Olympiades 2, Brussels, Belgium;*
6. IDENTIFICATION OF INDIVIDUAL SLIT VALVES IN SEMICONDUCTOR MANUFACTURING EQUIPMENT USING THEIR VIBRATION SIGNATURES, **M. W. Musselman[1], H. Xie[2] and D. Djurdjanovic[2],** *[1]Lam Research Corporation, Fremont, CA, USA; [2]Department of Mechanical Engineering, University of Texas, Austin, TX, USA.*
7. ISO 9001:2015 FDIS VERSION - CHALLENGES AND OPPORTUNITIES, **Dr. Isaac Sheps,** *Senior Executive Advisor to Carlsberg Group's CEO and the Excom, Israel;*
8. INTEGRATION OF MODELING AND SIMULATION TOOLS TOWARDS VIRTUAL MACHINE TOOL, **G. Constantin**, *Machines and Manufacturing Systems Department, University "Politehnica" of Bucharest, Romania;*
9. TQM IN PHARAMACEUTICAL COMPANIES IN SERBIA, **V. Marinković[1], T. Šibalija[2], S. Bekčić[3], G. Pejovic[4], V. Majstorović[5], Lj. Tasić[1]** *[1]Belgrade University, Faculty of Pharmacy, [2]Metroplitan University, Faculty of Management, Belgrade, [3]Institute Torlak, Belgrade, [4]Belgrade University, [4] Medicines and Medical Devices Agency of Serbia, Belgrade, Serbia, [5]Mechanical Engineering Faculty, Belgrade,Sebia;*

Time	Hall 211 (Second floor)

15:00-16.30

TQM 2015 / Session 4 – Young PhD researchers

Chairmen Session:

Ina Heine, *Laboratory for Machine Tools and Production Engineering, RWTH Aachen University, Aachen, Germany.*

Philip Karcher, *Fraunhofer-Institute for Production Systems and Design Technology IPK, Quality Management Pascalstr. 8-9, 10587 Berlin, Germany;*

Slavenko M. Stojadinovic, *Production Engineering Department, Laboratory for Quality Management and Production Metrology, Faculty of Mechanical Engineering, Kraljice Marije 16, Belgrade, Serbia;*

Mussa Mahmud, *Faculty of Engineering-Egdabia., University Benghazi, Libya;*

Nemanja Majstorovic, *Faculty of Detistry, Belgrade, Serbia*;

Svetoslav Georgiev, *Graduate School of Economics and Management, Tohoku University, Sendai, Japan.*

1. **CRITICAL INCIDENTS OF QUALITY ORIENTATION IN LOWER AND MIDDLE MANAGEMENT, Introduction paper, I. Heine, R. Schmitt, and P. Beaujean,** *Laboratory for Machine Tools and Production Engineering, RWTH Aachen University, Aachen, Germany.*
2. **METHODOLOGY FOR A COMPETENCY-BASED TEAM ORGANIZATION IN ACCORDANCE WITH DIN EN ISO 50001, P. Karcher, N. Fritz, L. Rumoeller, T. Theiss and R. Jochem**, *Fraunhofer-Institute for Production Systems and Design Technology IPK, Quality Management Pascalstr. 8-9, 10587 Berlin, Germany;*
3. **AN ALGORITHM FOR SIMULATION CMM MEASURING PATH BASED ON THE CAD MODEL, Slavenko M. Stojadinovic, Prof. Dr Vidosav D. Majstorovic,** *Production Engineering Department, Laboratory for Quality Management and Production Metrology, Faculty of Mechanical Engineering, Kraljice Marije 16, Belgrade, Serbia;*
4. **LOCAL COMPARISON OF MULTIMODAL MEDICAL SURFACES USING A COMPOUND REGISTRATION-RECONSTRUCTION ALGORITHM, Mussa Mahmud 1, Ahmad Imjabber 1 , Moamer Ehtash 2, David Joannic 2,** *1 Faculty of Engineering-Egdabia., University Benghazi,- Libya; 1 ECE Department, University of Sebha, Libya, 2 High Institute for Engineering professions, Tripoli- Libya; 2 Laboratoire d'Electronique, Informatique et Image (Le2i), Université de Bourgogne, AUXERRE, France;*
5. **DETERMINATION ORTODONTICS PARAMETERS BY GEOMETRICAL ENTITIES, N. Majstorovic, B. Glisic,** *Faculty of Detistry, Belgrade, Serbia*; **L. Čerče, Prof. Dr. M. Soković, Prof. Dr. J. Kopač**, *Faculty of Mechanical Engineering, Ljubljana, Slovenia.*
6. **THE UNFORTUNATE LEGACY OF TRANSITION ECONOMIES: A COMPARISON BETWEEN BULGARIA AND THE REST OF THE CENTRAL AND EASTERN EUROPEAN STATES IN THE FIELD OF QUALITY MANAGEMENT, Svetoslav Georgiev, Seiichi Ohtaki**, *Graduate School of Economics and Management, Tohoku University, Sendai, Japan.*

Time	Hall 518 (Fifth floor)
15:00-16.30	***TQM 2015 / Session 5 – Quality management and advance regulations***

Chairmen Session:

Prof. Dr. Predrag Popović, *Institute for Nuclear Sciences Vinča, M. Petrovića Alasa 12, Belgrade, Republic of Serbia;*

Miroslav Tufegdžić, *Institut za nuklearne nauke "VINČA", 11001 Beograd, p p. 522, Serbia;*

Ankica R. Milinković, *Calibration Laboratory, Vekom Geo, Trebinjska 24, Belgrade, 11000, Serbia;*

Dejan Brankovic, *SHP Celex Banja Luka, Veljka Mladjenovica bb, 78000 Banja Luka, Bosnia and Herzegovina.*

Jasmina Vesić - Vasović, *Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save St.,65, Čačak, Serbia.*

1. **RISK ASSESSMENT FOR RADIO AND TELECOMMUNICATION TERMINAL EQUIPMENT, Introduction paper, A. Bašić[1], P. Popović[2],** [1] *RATEL, Višnjićeva 8, Belgrade, Republic of Serbia;* [2] *Institute for Nuclear Sciences Vinča, M. Petrovića Alasa 12, Belgrade, Republic of Serbia;*
2. **THE CERTIFICATION PROCEDURE OF EMPTY ENCLOSURES OF ELECTRICAL EQUIPMENT AS COMPONENTS, ACCORDING TO EUROPEAN DIRECTIVE "ATEX", M. Tufegdžić, A. Đurđević, A. Videnović,** *Institut za nuklearne nauke "VINČA", 11001 Beograd, p p. 522, Serbia;*
3. **APPLYING THE REGULATION (EC) No 765/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL ON THE IMPLEMENTATION CROSS-BORDER ACCREDITATION CAB WITH MULTISITE APPROACH, Ankica R. Milinković,** *Calibration Laboratory, Vekom Geo, Trebinjska 24, Belgrade, 11000, Serbia;*
4. **THE PREFORMANCE OF IMPLEMENTATION OF INVESTMENT ACTIVITIES BY APPLYING THE MODEL OF INFLUENCE, Dejan Brankovic [1], Zdravko N. Milovanovic [2], Stevo Borojević** [31]*SHP Celex Banja Luka, Veljka Mladjenovica bb, 78000 Banja Luka, Bosnia and Herzegovina,* [2 and 3] *University of Banja Luka, Faculty of Mechaical Engineering, Stepe Stepanovica 71, Republic of Srpska, Bosnia and Herzegovina.*
5. **INCREASE OF EFFICIENCY OF MULTI-CRITERIA DECISION MAKING PROCESS IN THE SELECTION OF DEVELOPMENT INVESTMENT PROJECTS, Jasmina Vesić Vasović[a*], Miroslav Radojičić[a],** Predrag Popović[b], Zoran Nešić[a], [a]*Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save St.,65, Čačak, Serbia,* [b]*Vinča Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia*

Time	Hall 211 (Second floor)
16:30-18.00	**TQM 2015 / Session 6 – TQM and Knowledge Management** **Chairmen Session:** **Prof. Dr. Abel Ribeiro de Jesus,** *Mechanical Engineering Department, Polytechnic School of the Federal University at Bahia, Salvador, Brazil;* **Dr. Sebastian Marius Rosu,** *Special Telecommunications Service, Radio Communications Department, 323A Splaiul Independentei, sector 6, 060032, Bucharest, Romania.* **Prof. Dr. Aida Habul,** *Ekonomski fakultet Sarajevo, Trg Alije Izetbegovića br.1,71000 Sarajevo-Bosna i Hercegovina.* **Prof. Dr. Dana Stancekova,** *Department of Machining and Manufacturing Engineering, University of Zilina, Univerzitna 1, 010 26 Zilina, Slovakia;* **Dr. Muhammad Saleem,** *Engineering Management Department, NUST College of Electrical & Mechanical Engineering (E&ME), Peshawar Road Rawalpindi, Pakistan.* 1. **AFTER 20 YEARS, WHAT HAS REMAINED OF TQM? - A MULTI CASE STUDY, Introduction paper, Lis Lisboa Bernardino[1)]** - *Administration School, Federal University at Bahia, Salvador, Brazil,* **Francisco Lima Cruz Teixeira[1)] – Ava Santana Barbosa[2)]** - Mechanical Engineering Department, Polytechnic School of the Federal University at Bahia, Salvador, Brazil; **Abel Ribeiro de Jesus[2)] - Mauricio de Jesus Lordelo[2)]** - Mechanical Engineering Department, Polytechnic School of the Federal University at Bahia, Salvador, Brazil; 2. **THE INTELLIGENT ENTERPRISE WiMAX NETWORK SOLUTION TO IMPROVE THE BUSINESS MANAGEMENT, Sebastian Marius Rosu[1], George Dragoi[2], Ionel Bujorel Pavaloiu[2], Dan Alexandru Mitrea[21)]** *Special Telecommunications Service, Radio Communications Department, 323A Splaiul Independentei, sector 6, 060032, Bucharest, Romania, Politehnica" University of Bucharest, Faculty of Engineering in Foreign Languages, 313 Splaiul Independenţei, sector 6, 060042, Bucharest, Romania;* 3. **QMS - TQM, THEIR OPPOSITES AND THE ROLE OF THE MANAGER, Prof. Dr. Aida Habul,** *Ekonomski fakultet Sarajevo, Trg Alije Izetbegovića br.1,71000 Sarajevo-Bosna i Hercegovina,* Mr.sci Ismet Šemić, *konsultant/auditor, for ISO 9001, ISO 14001, ISO 50001, ISO 27001, Saba-Ing d.o.o., str. Hamdije Čemerlića br. 9, 71000 Sarajevo,Bosna i Hercegovina;* 4. **HOW TO IMPLEMENT OF KNOWLEDGE PROCESSES IN SMALL AND MEDIUM BUSINESS, [1]I. Litvaj, [2]D. Stancekova,** *[1]Department of Power Electrical Systems, University of Zilina, Univerzitna 1, 010 26 Zilina, Slovakia, [2]Department of Machining and Manufacturing Engineering, University of Zilina, Univerzitna 1, 010 26 Zilina, Slovakia;* 5. **EMPLOYEE RETENTION THROUGH KAIZEN CULTURE - A CASE STUDY OF AN AUTOMOBILE WORKSHOP COMPANY, Muhammad Saleem[1] Dr Nawar Khan[2] Dr Tasweer Hussian Syed[3], Dr Syed Waheed ul Haq[4],** *[1] Engineering Management Department, NUST College of Electrical & Mechanical Engineering (E&ME), Peshawar Road Rawalpindi, Pakistan.*

Time	Hall 518 (Fifth floor)
17:00-18.30	**TQM 2015 / Session 7 – Continuous improvement** **Chairmen Session:** **Prof. Dr. Branko Djedović,** *School for business applied studies, Cacak; 11080, Belgrade, 2 Gradski park Street, Serbia;* **Prof. Dr. Dragana Makajić-Nikolić,** *University of Belgrade, Faculty of Organizational Sciences, Jove Ilića 154, Belgrade, Serbia;* **Velimir R. Komadinić,** *LOLA Institute, Kneza Višeslava 70a, 11030 Belgrade, Serbia.* **Ljiljana Pecić,** *College of Applied Professional Mechanical Studies Trstenik, Serbia;* **Nebojsa Denic,** *Faculty of information Technology, Alfa University, Palmira Toljatija 3 , Belgrade, Serbia.* 1. **STATISTICAL METHODS OF TESTING PROJECT QUALITY BY DETERMINING THE EFFECTS ON ECONOMIC INDICES, Introduction paper, Professor Branko Djedović, PhD,** *School for business applied studies, Cacak; 11080, Belgrade, 2 Gradski park Street,* **Professor Dragana Petrović, PhD,** *School for business applied studies, Cacak; from Belgrade, 11080 Belgrade, 2 Gradski park Street, Serbia;* 2. **FOOD SAFETY RISK ASSESSMENT USING THE BOW TIE METHOD, Mihailo Roković, Dragana Makajić-Nikolić, Ana Belić, Mirko Vujošević,** *University of Belgrade, Faculty of Organizational Sciences, Jove Ilića 154, Belgrade, Serbia;* 3. **INTEGRATION OF MANAGEMENT SYSTEM - KEY ISSUES, Velimir R. Komadinić 1, Vidosav D. Majstorović 2,** *1: LOLA Institute, Kneza Višeslava 70a, 11030 Belgrade, Serbia; 2:University of Belgrade, Mechanical Engineering Faculty, Laboratory for Production Metrology and TQM, Kraljice marije 16., 11120 Belgrade, Serbia.* 4. **RESEARCH INTO THE FACTORS INFLUENCING THE MARKET ORIENTATION OF SMEs IN TRANSITION, Ljiljana Pecić[1], Milan Kolarević[2]** *[1]College of Applied Professional Mechanical Studies Trstenik, Serbia; [2]Faculty of Mechanical and Civil Engineering in Kraljevo, University oin Kragujevac, Kragujevac, Serbia;* 5. **QUALITY MANAGEMENT IN IT PROJECTS, Nebojsa Denic[1], Vesna Stevanović[1]** *Faculty of information Technology, Alfa University, Palmira Toljatija 3 , Belgrade, Serbia*

20:30 IWC TQM 2015 / **Conference Dinner (informal).**

The 8th IWC TQM CONFERENCE PROGRAM

Date: 3rd June, 2015 / Wednesday	***Place: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade***

Registration desk: **08:00 – 16:30** Registration / **CeNT** (first level)

Time	**Hall 211** (Second floor)
09:00-10:30	**TQM 2015 / Session 8 – Special Conference "Manufuture in Serbia 2015" / Advanced Manufacturing Technology.** **Chairmen Session:** **Prof. Dr. Miroslav Trajanović,** *University of Niš, Faculty of Mechanical Engineering in Niš, Aleksandra, Medvedeva 14, Niš, 18000, Serbia;* **Prof. Dr. Nikolaos M. Vaxevanidis,** School of Pedagogical & Technological Education (ASPETE)-Department of Mechanical Engineering-Laboratory of Manufacturing Processes and Machine Tools (LMProMaT), N. Heraklion,14121 Athens, Greece; **Goran Mladenovic**, *Faculty of Mechanical Engineering, University of Belgrade, Department, Of Production Engineering, Kraljice Marije 16, 11120 Belgrade 35, Serbia;* **Milica Petrovic**, *Faculty of Mechanical Engineering, University of Belgrade, Department, Of Production Engineering, Kraljice Marije 16, 11120 Belgrade 35, Serbia;* **Igor Zukan**, *Quality Engineer Production, Grundfos Manufacturing Serbia, QEHS department, Obliazni put-Sever 21, 22320 Indjija, Serbia.* **Keynote Speakers:** 1. **REVERSE MODELING OF HUMAN HUMERUS BY THE METHOD OF ANATOMICAL FEATURES (MAF), Mohammed Rashid, Karim Husain, Nikola Vitković, Miodrag Manić, Miroslav Trajanović, Jelena Milovanović, Ljiljana Radović**, *University of Niš, Faculty of Mechanical Engineering in Niš, Aleksandra, Medvedeva 14, Niš, 18000, Serbia;* 2. **VIRTUAL QUALITY ASSESSMENT FOR SCULPTURED SURFACE CNC TOOL PATH STRATEGIES AND RELATED PARAMETERS USING RSM AND DEVELOPED MODEL FOR INSPECTION, Nikolaos A. Fountas[1], Tatjana V. *Šibalija*[2], Vidosav D. Majstorovic[3], Nikolaos M. Vaxevanidis[1] , Jelena Macuzic[3], Srdjan Zivkovic[4]**, *[1]School of Pedagogical & Technological Education (ASPETE)-Department of Mechanical Engineering-Laboratory of Manufacturing Processes and Machine Tools (LMProMaT), N. Heraklion,14121 Athens, Greece; [2]Faculty of Management, Metropolitan University, Tadeusa Koscuska 63, 11000 Belgrade, Serbia; [3]Faculty of Mechanical Engineering, University of Belgrade, Kraljice Marije 16, 11120 Belgrade, Serbia; [4]Military Institute, Žarkovo, Belgrade, Serbia;* 3. **ERROR DETERMINATION FOR 3-AXIS MILLING OF FREE FORM SURFACES, G. Mladenovic, Lj. Tanovic, M. Pjevic**, *Faculty of Mechanical Engineering, University of Belgrade, Department, Of Production Engineering, Kraljice Marije 16, 11120 Belgrade 35, Serbia;* 4. **MODIFIED CHAOTIC PARTICLE SWARM OPTIMIZATION ALGORITHM FOR FLEXIBLE PROCESS PLANNING, Milica Petrović[1], Marko Mitić[1], Najdan Vuković[2], Jelena Petronijević[1], Zoran Miljković[1], Bojan *Babić*[11]***University of Belgrade – Faculty of Mechanical Engineering, Production Engineering Department, Kraljice Marije 16, 11120 Belgrade 35, Serbia; [2]University of

	Belgrade – Faculty of Mechanical Engineering, Innovation Center, Kraljice Marije 16, 11120 Belgrade 35, Serbia; 5. **IMPLEMENTATION OF CALIBRATION SYSTEM AND ESTIMATION OF UNCERTAINTY IN MEASUREMENT**, **M.Sc. Igor Zukan**, *Quality Engineer Production, Grundfos Manufacturing Serbia, QEHS department, Obliazni put-Sever 21, 22320 Indjija, Serbia.*
Time	**Hall 518** (Fifth floor)
09:00-10:30	**TQM 2015 / Session 9 – Advanced Quality Model – ISO 9001:2015** **Chairmen Session:** **Dr. eng. Cristinel Roncea**, *SRAC CERT, 14 Vasile Parvan, Bucharest, Romania;* **Prof. Dr. Srđan Vulanović**, *Faculty of Technical Sciences, Novi Sad, Department for Industrial Engineering and Management, Trg Dositeja Obradovića 6, Novi Sad, Serbia;* **Ivana Veličković**, *Production Engineering Department, Laboratory for Quality Management and Production Metrology, Faculty of Mechanical Engineering, Kraljice Marije 16, Belgrade, Serbia.* **Dr. Andrei Kolosovskii**, *Kaliningrad State Technical University, Sovetskii prospect 1, 236022 Kaliningrad, Russia.* **Leon Ljubić**, *JKP "Parking servis Kragujevac", Kragujevac, Vojislava Kalanovića b.b., 34000 Kragujevac Serbia.* 1. **AUDIT OF THE MANAGEMENT SYSTEMS IN THE CONTEXT OF NEW APPROACH IMPOSED BY ANNEX SL HIGH LEVEL STRUCTURE**, **Introduction paper**, **PhD. eng. Cristinel Roncea**, *SRAC CERT, 14 Vasile Parvan, Bucharest, Romania;* 2. **ESTABLISHING THE ORGANIZATION`S CONTEXT – THE FIRST STEP TO RISK BASED QUALITY MANAGEMENT SYSTEM**, **Srđan Vulanović PhD[1)], Vladan Radlovački PhD[1)], Milan Delić PhD[1)], Ivan Beker PhD[1)];** [1)]*Faculty of Technical Sciences, Novi Sad, Department for Industrial Engineering and Management, Trg Dositeja Obradovića 6, Novi Sad, Serbia;* 3. **INTEGRATION OF MANAGEMENT SYSTEMS BASED ON PROCESS APPROACH AND ISO 9001:2015 AS AN INTEGRATION PLATFORM**, **I. Veličković, Prof. Dr.V.Majstorivić**, *Production Engineering Department, Laboratory for Quality Management and Production Metrology, Faculty of Mechanical Engineering, Kraljice Marije 16, Belgrade, Serbia.* 4. **OVERVIEW OF THE EUROPEAN FORUM: HORIZON 2020 ON THE PROGRAMME OF REINDUSTRIALIZATION OF EUROPE**, **Andrei Kolosovskii**, *Kaliningrad State Technical University, Sovetskii prospect 1, 236022 Kaliningrad, Russia.* 5. **BUSINESS PROCESS ANALYSIS OF INFORMATION SYSTEM FOR HUMAN RESOURCES MANAGEMENT IN THE FUNCTION OF IMPROVING BUSINESS QUALITY**, **Leon Ljubić[a], Dejana Popović[b], Zoran Nešić[c*], Miroslav Radojičić[c], Jasmina Vesić Vasović[c]**, [a]*JKP "Parking servis Kragujevac", Kragujevac, Vojislava Kalanovića b.b., 34000 Kragujevac Serbia,* [b]*Vinča Institute of Nuclear Sciences, University of Belgrade, 11001 Belgrade, Serbia,* [c]*Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save St.,65, 32000 Čačak, Serbia;*

Time	Hall 211 (Second floor)
11:00-12:30	**TQM 2015 / Special Conference / 6th Balkan Conference on Quality / 7th Balkan Quality Forum - THE BALKAN AS A REGION OF QUALITY** ***Conference Co-Chairs and Founders:*** *Prof. Dr. V. Majstorovic (Serbia), Prof. Dr. Lidia Petrova Galabova (Bulgaria), Prof. Dr. N.M. Vaxevanidis (Greece), Prof. Dr. N. Dragulanesku (Romania).* **Chairmen Session:** **Boyka Nenkova,** *GCR Ltd., 10 Vihren Str., 1618 Sofia, Bulgaria.* **Prof. Dr. Nicolae DRĂGULĂNESCU**, *University POLITEHNICA of Bucharest, Romania;* **MSc Sonja Čerepnalkovska**, *Standardization Institute of the Republic of Macedonia - ISRM, Vasil Glavinov br.8, 1000 Skopje, Republic of Macedonia;* **Prof. dr Miroslav Bobrek,** *Faculty of mechanical engineering, University of Banjaluka, S. Stepanovica 75,Banjaluka, 78000 BiH-RS.* **Prof. Dr. Adrian Stere Paris,** *Department of Materials Technology, University Politehnica, 313, Spl. Independentei, Bucarest, CP 060042, Romania.* **Dr. Srdjan Živković**, *Military Technical Institute Belgrade, Ratka Resanovića 1, 11030 Belgrade Serbia;* **Keynote Speakers:** 1. **PERFORMANCE INDICATORS FOR ASSESSMENT OF INTEGRATED MANAGEMENT SYSTEM EFFECTIVENESS, B. Nenkova[1], B. Manchev[2], E. *Tomov*[3]** *1 GCR Ltd., 10 Vihren Str., 1618 Sofia, Bulgaria, 2, 3 Risk Engineering Ltd., 10 Vihren Str., 1618 Sofia, Bulgaria.* 2. **QUARTER CENTURY OF QUALITY MANAGEMENT AND CONSUMER PROTECTION IN ROMANIA, Nicolae DRĂGULĂNESCU, Ph.D, Ph.D, Professor**, *University POLITEHNICA of Bucharest, Romania;* 3. **BUSINESS PROCESS IMPROVEMENT BASED ON RISK, Sonja Čerepnalkovska[1], M.Sc.; Dr. Ivan Beker[2],** *[1]Standardization Institute of the Republic of Macedonia - ISRM, Vasil Glavinov br.8, 1000 Skopje, Republic of Macedonia; [2]University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Department of Industrial Engineering and Management, Trg Dositeja Obradovića 6, Novi Sad, Srbija;* 4. **QUALITOLOGY AND SYSTEMS ENGINEERING AS A MAIN SOURCE OF KNOWLEDGE FOR EFFECTIVE QUALITY MANAGEMENT, Prof. dr Miroslav Bobrek**, *Faculty of mechanical engineering, University of Banjaluka, S. Stepanovica 75,Banjaluka, 78000 BiH-RS.* 5. **MULTIVARIATE STATISTIC DECISION DESIGN, Adrian Stere Paris[1], Constantin Târcolea[2]** *[1]Department of Materials Technology, [2]Department of Mathematics, University Politehnica, 313, Spl. Independentei, Bucarest, CP 060042, Romania.* 6. **IMPLEMENTATION OF ANALYTIC HIERARCHY PROCESS METHOD IN THE SELECTION OF THE OPTIMAL PLM SOLUTION, Srdjan Živković, Zoran Vasić, Miodrag Ivanišević**, *Military Technical Institute Belgrade, Ratka Resanovića 1, 11030 Belgrade Serbia;*

Time	Hall 518 (Fifth floor)
11:00-13:00	**TQM 2015 / Session 11 - Quality management in service sectors** **Chairmen Session:** **Dariusz Kosiorek,** *Faculty of Management, Warsaw University of Technology, Narbutta Street 85, 02-524, Warszawa, Poland;* **Prof. Dr. Marijana T. Petrović,** *Faculty of transport and traffic engineering Vojvode Stepe 305,Belgrade, Serbia;* **Prof. Dr. Dragan Ćoćkalo,** *University of Novi Sad, Technical faculty "Mihajlo Pupin" in Zrenjanin, 23000 Zrenjanin, Djure Djakovica bb, Republic of Serbia* **Prof. Dr. A.El Kashlan,** *Productivity and Quality Institute[3], P.O.Box 1029, Abo keir, Alexandria, Egypt.* **Prof. Dr. Marijana Vidas-Bubanja,** *Alpha University, Belgrade, Blegrade, Kraljice Marije 73, Serbia.* 1. **CONNECTIONS BETWEEN EXCELLENCE PRINCIPLES AND ORGANIZATIONAL CULTURE, Introduction paper, Katarzyna Szczepańska, Dariusz Kosiorek,** *Faculty of Management, Warsaw University of Technology, Narbutta Street 85, 02-524, Warszawa, Poland; Dynamic Consulting, Makuszyńskiego Street 6, 41-808, Zabrze, Poland;* 2. **IMPROVING CUSTOMER CONTACT OPERATIONS WITH PERFORMANCE MANAGEMENT STANDARD: THE CASE OF MOBILE COMMUNICATION SERVICES, Marijana T. Petrović[1], Tatjana L. Manojlović[2], Snežana A. Pejčić *Tarle*[11]***Faculty of transport and traffic engineering Vojvode Stepe 305,Belgrade, Serbia; [2]Group Industrial Development,Telenor, Omladinskih brigade 90, Belgrade, Serbia;* 3. **ATTITUDES OF UNDERGRADUATE BUSINESS STUDENTS' IN SERBIA TOWARDS CSR AND COMPETITIVENESS, Dragan Ćoćkalo[1], Srđan Bogetić[2], Dejan Đorđević[3], Bešić Cariša[4],** *[1]Associate professor, University of Novi Sad, Technical faculty "Mihajlo Pupin" in Zrenjanin, 23000 Zrenjanin, Djure Djakovica bb, Republic of Serbia, [2]Professor, Belgrade Business School, 11000 Belgrade, Kraljice Marije 73, Republic of Serbia, [3]Professor, University of Novi Sad, Technical faculty "Mihajlo Pupin" in Zrenjanin, 23000 Zrenjanin, Djure Djakovica bb, Republic of Serbia, [4]Associate Professor, University of Kragujevac, Faculty of technical science Čačak, 32000 Čačak, Svetog Save 65, Republic of Serbia;* 4. **A PROPSED SERVICE QUALITY MODEL TO ACHIEVE USER SATISFACTION/LOYALTY FOR LIBRARY USERS: A CASE STUDY ON BIBLIOTHECA ALEXANDRINA, Reham Adel[1], Rasha Mohsen[2], A.El kashlan[3]** *Academy for Science and Technology[1], Bibliotheca Alexandrina[2], Productivity and Quality Institute[3], P.O.Box 1029, Abo keir, Alexandria, Egypt.* 5. **ICT AS A BASEMENT FOR QUOLITY IMPROVEMENTS IN HEALTH SERVICES, Marijana Vidas-Bubanja, PhD,** *Belgrade Business School and Faculty for Trade and Banking, Alpha University, Belgrade, Blegrade, Kraljice Marije 73, Serbia.*

Hall 211 (Second floor)

15.00 – 16.30 TQM2015 / Session 12 – Workshop 2 / - *Holistic Approaches to Quality Improvement in Manufacturing*

Prof. Dr. Jun Ni, *College of Engineering, University of Michigan, Ann Arbor, MI 48109, USA.*

Over the last hundred years, much progress has been made in manufacturing quality. Globalization competitions have further pushed quality improvement to a new level. This presentation will first review some of the early quality control and improvement efforts such as SPC, design of experiments, quality engineering, etc. Then, several recent research directions will be presented with some highlighted real manufacturing examples. These include: (1) in-process quality improvement technologies (e.g., real-time error compensation, machining chatter suppression, active balancing for improved quality), (2) stream-of-variation modeling and automatic root cause identifications (e.g., dimensional variation reduction for automobile body assembly, continuous baby diaper production process, and progressive stamping fault diagnosis), (3) high-definition metrology driven process control (e.g., machined surface error detection and compensation, tool wear estimation and compensation, assembly fault detection), (4) robust process optimization (e.g., stamping tonnage optimization for variation reduction, fixture design optimization), (5) design for variation elimination (e.g., automobile body assembly), (6) process innovations (e.g., ultrasonic assisted friction stir welding for improved quality, dry/near dry electric-discharge machining for additive manufacturing), and (7) intelligent maintenance strategies (e.g., fault and anomaly detection, engineering immune system, maintenance decision support for yield improvement).

Time	Hall 518 (Fifth floor)
15:00-16:30	**TQM 2015 / Session 13 - Advanced approaches of quality and metrology** **Chairmen Session:** **Prof. Dr. R.Furutani,** *School of Engineering, Tokyo Denki University, Senju-Asahi-cho 5, Adachi, 120-8551 Tokyo, Japan;* **Prof. Dr. Mirko Sokovic**, *Faculty of Mechanical Engineering, University of Ljubljana, Slovenia;* **Prof. Dr. Zivana Jakovljevic**, *University of Belgrade, Faculty of Mechanical Engineering, Department for Production Engineering, Kraljice Marije 16, Belgrade, 11000, Serbia;* **Prof. Dr. Vladan Radlovački,** *Department of Industrial Engineering and Engineering Management, Faculty of Technical Sciences, Trg Dosijeta Obradovica 6, 21000 Novi Sad, Serbia;* **Prof. Dr. Miodrag Hadžistević,** *University of Novi Sad, Faculty of Technical Sciences, Department of Production Engineering, Trg Dositeja Obradovica 6, 21000 Novi Sad, Serbia;* 1. **EVALUATION OF SIMPLIFIED PERFORMANCE TEST OF CMM, Introduction paper,** R.Furutani and M.Ozaki, *School of Engineering, Tokyo Denki University, Senju-Asahi-cho 5, Adachi, 120-8551 TOKYO, Japan;* 2. **MULTICRITERIA OPTIMIZATION OF CILINDER MANUFACTURING USING QUALITY TECHNIQUES, P. Eniko [1], B. Plesec [1], M. Sokovic [2], D. Kramar [2],** [1] *MAPRO d.o.o., Industrijska ulica 12, Ziri, Slovenia;* [2] *Faculty of Mechanical Engineering, University of Ljubljana, Slovenia;* 3. **RECOGNITION OF ONE CLASS OF QUADRIC SURFACES FROM UNSTRUCTURED POINT CLOUD, Zivana Jakovljevic, Veljko Markovic**, *University of Belgrade, Faculty of Mechanical Engineering, Department for Production Engineering, Kraljice Marije 16, Belgrade, 11000, Serbia;* 4. **DIFERENT APPROACHES IN UNCERTAINTY ESTIMATION FOR FLATNESS MEASUREMENTS USING COORDINATE MEASURING MACHINE, Štrbac, B[1]., Hodolič, J[1]., Spasić – Jokić, V[2]., Radlovački, V[3]., Hadžistević, M[1].,** *[1]Department of Production Engineering, Faculty of Technical Sciences [2]Department of Power, Electronic and Telecommunication Engineering, Faculty of Technical Sciences, [3]Department of Industrial Engineering and Engineering Management, Faculty of Technical Sciences, Trg Dosijeta Obradovica 6, 21000 Novi Sad, Serbia;* 5. **THE QUALITY MANAGEMENT OF THE INJECTION MOLDING PROCESS, Matin, I., Hadzistevic, M., Hodolic, J., Vukelic, D., Medic,** V., *University of Novi Sad, Faculty of Technical Sciences, Department of Production Engineering, Trg Dositeja Obradovica 6, 21000 Novi Sad, Serbia;*

Time	Hall 518 (5th floor)
17:00-18:30	**TQM 2015 / Session 14 - QM and enable technologies** **Chairmen Session:** **Sebastian Schötz**, *Fraunhofer Project Group Process Innovation, Universitaetsstrasse 30, 95447 Bayreuth, Bavaria, Germany;* **Prof. Dr. Vilos E. Ilios,** *Faculty of Technical science Bitola, University St.Kliment Ohridski Bitola – Bul."1-vi Maj" BB, Bitola, 7000 Bitola, Macedonia;* **Rayna Dimitrova,** *Department Material Science and Technology, Technical University-Sofia, Bulgaria.* **Gayathiri Madheswaran**, *Manager – Department of Quality Control, Department of Quality Control, Rashid Printers and Stationers, New Industrial Area, Ajman, United Arab Emirates;* **Angela Fajsi,** *Department of Industrial Engineering and Management, Faculty of Technical Sciences, Trg Dositeja Obradovića 6, Novi Sad, Republic of Serbia;* 1. **A MATHEMATICAL METHODOLOGY TO ACHIEVE AN ECONOMICAL AND ENERGETIC OPTIMAL QUALITY CONTROL WITHIN THE PRODUCTION**, **Introduction paper, Sebastian Schötz 1, Steffen Butzer 1, Rolf Steinhilper 2**, *1 Fraunhofer Project Group Process Innovation, Universitaetsstrasse 30, 95447 Bayreuth, Bavaria, Germany; 2 Chair Manufacturing and Remanufacturing Technology, University of Bayreuth, Universitaetsstrasse 30, 95447 Bayreuth, Bavaria, Germany;* 2. **IMPACT OF VARIATION OF THE GEOMETRIC CHARACTERISTICS AND PROPERTY OF THE MATERIALS TO THE BEARING CAPACITRY OF SIMPLE SINGLE BOLT SHEAR LOADED CONNECTION**, **Vilos E. Ilios, *Assoc. Prof.,*** *Faculty of Technical science Bitola, University St.Kliment Ohridski Bitola – Bul."1-vi Maj" BB, Bitola, 7000 Bitola, Macedonia;* 3. **ELECTROLESS NICKEL COATINGS ON SILICONE CARBIDE PARTICLES USING TWO NICKEL SALTS IN ALKALINE SOLUTION, Rayna Dimitrova,** *Department Material Science and Technology, Technical University-Sofia, Bulgaria.* 4. **BUSINESS PROCESS IMPROVEMENT WITH PDCA APPROACH & PROCESS REENGINEERING IN PRINTING PRESS**, **Gayathiri Madheswaran**, *Manager – Department of Quality Control, Department of Quality Control, Rashid Printers and Stationers, New Industrial Area, Ajman, United Arab Emirates;* 5. **THE TREND OF TECHNOLOGICAL FORECASTING IN THE QUALITY IMPROVEMENT PROCESS**, **Angela Fajsi, Slobodan Morača, Miloš Jovanović**, *Department of Industrial Engineering and Management, Faculty of Technical Sciences, Trg Dositeja Obradovića 6, Novi Sad, Republic of Serbia;*

Time	Hall 211 (Second floor)
17:00-18:30	**TQM 2015 / Session 15 - Quality management in education and education for Quality** **Chairmen Session:** **Prof. Dr. Kristina Zgodavova**, *Department of Integrated Management, Technical University of Kosice, Letna 9, SK-04200 Kosice, Slovakia;* **Prof. Dr. Nicolae Drăgulănescu,** *University POLITEHNICA of Bucharest, Romania;* **Prof. Dr. A. El Kashlan,** *Academy for Science and Technology: Productivity and Quality Institute, P.O. Box 1029, Alexandria, Egypt.* **Prof. Dr. Tzvetelin K. Gueorguiev,** *Department of Machine Tools and Manufacturing, University of Ruse 'Angel Kanchev', Address, Ruse, 7017, Bulgaria;* 1. **INTELLIGENT APPROACHES FOR ORGANISATIONS´ MANAGEMENT SYSTEM CHANGE: WEB BASED ROLE PLAY SIMULATION ENVIRONMENT, Introduction paper, Kristina Zgodavova, Andrea Sutoova, Matus Kisela**, *Department of Integrated Management, Technical University of Kosice, Letna 9, SK-04200 Kosice, Slovakia;* 2. **PLAGIARISM BECAME A BASIC CHALLENGE OF QUALITY ASSURANCE IN EDUCATION - CASE STUDY: ROMANIAN STUDENTS' AND TEACHERS' VIEWS ON PLAGIARISM, Nicolae Drăgulănescu, Ph.D, Ph.D, Professor**, *University POLITEHNICA of Bucharest, Romania;* 3. **IMPROVING THE EDUCATIONAL SYSTEM AT PRIVATE UNIVERSITIES IN EGYPT THROUGH IMPLEMENTING TOTAL QUALITY MANAGEMENT, M. Abd Rabou, A. El Kashlan**, *Academy for Science and Technology: Productivity and Quality Institute, P.O. Box 1029, Alexandria, Egypt.* 4. **TEACHING PROFESSIONAL ENGLISH TO THE QUALITY SPECIALISTS OF TOMORROW, Tzvetelin K. Gueorguiev**, *Department of Machine Tools and Manufacturing, University of Ruse 'Angel Kanchev', Address, Ruse, 7017, Bulgaria;*

The 8th IWC TQM CONFERENCE PROGRAM

Date: 4th June, 2015 / Thursday	***Place: Mechanical Engineering Faculty, str. Kraljice Marije 16, Belgrade***

Registration desk: **08:00 – 11:00** Registration

Time	**Hall 211** (Second floor)
09:00-10:30	**TQM 2015 / Session 16 - Quality engineering techniques application** **Chairmen Session:** **Prof. Dr. Sorin M. Croitoru,** *Department of Machines and Manufacturing Systems, Politehnica University of Bucharest, 313 Spl. Independentei, Sector 6, 060042-Bucharest, Romania;* **Prof. Dr. Katarina Monkova,** Department of technical systems design, TU Kosice, Faculty of Manufacturing Technologies with the seat in Presov, Sturova 31, 080 01 Presov, Slovakia; **Prof. Dr. Emilia Assenova,** *Society of Bulgarian Tribologists, 74B, G. Sofiiski St., 1606 Sofia, Bulgaria;* **Olga Štajdohar-Pađen,** *Energy Institute, Ulica grada Vukovara 37 10000 Zagreb, Croatia.* **Stevan J. Budimir,** *Institute Goša, Milana Rakića 35, 11000 Belgrade, Serbia;* 1. **EXPERIMENTAL RESEARCH OF TITANIUM IMPLANTS**, **Introduction paper, S.M. Croitoru [1)], I.N. Mihailescu [2)], D.A. Maris [3)], I.A. Popovici [4)]** *1) Department of Machines and Manufacturing |Systems, POLITEHNICA University of Bucharest, 313 Spl. Independentei, Sector 6, 060042-Bucharest, ROMANIA; 2) Lasers Department, "Laser-Surface-Plasma Interactions" Laboratory, National Institute for Lasers, Plasma and Radiation Physics, PO Box MG-36, RO-77125, Magurele, Ilfov, ROMANIA; 3) Faculty of Dentistry, OVIDIUS University of Constanta, 7 Ilarie Voronca Str., 900684-Constanta, ROMANIA; 4) Chair of Dental Implantology, University of Medicine and Pharmacy of Bucharest, 37 Dionisie Lupu Str., Sector 2, 020022-Bucharest, ROMANIA;* 2. **BENDING TESTS OF JOINTS FOR BUS SKELETON, [1]Peter Monka, [2]Katarina Monkova, [3]Filip Murgas,** [1,3] *Department of manufacturing technologies, TU Kosice, Faculty of Manufacturing Technologies with the seat in Presov, Sturova 31, 080 01 Presov, Slovakia;* [2]Department of technical systems design, TU Kosice, Faculty of Manufacturing Technologies with the seat in Presov, Sturova 31, 080 01 Presov, Slovakia; 3. **LUBRICANTS AND ADDITIVES IMPACT ON CONTACT SYSTEMS' QUALITY, Emilia Assenova[1], Mara Kandeva[2], Vidosav Majstorovic[3],** *[1]Society of Bulgarian Tribologists, 74B, G. Sofiiski St., 1606 Sofia, Bulgaria; [2]Technical University-Sofia, Faculty of Industrial Engineering, Tribology Center, 8, Blvd Kl. Ohridski, 1156 Sofia, Bulgaria; [3]University of Belgrade, Faculty of Mechanical Engineering, Laboratory for Production Metrology and TQM, Kraljice Marije 16, 11120 Belgrade 35, Serbia;* 4. **QUALITY MANAGEMENT AT DESIGNING AND BUILDING OF ELECTRICAL POWER FACILITIES, Olga Štajdohar-Pađen,** *Energy Institute, Ulica grada Vukovara 37 10000 Zagreb, Croatia.* 5. **MANUFACTURING COSTS OF GASKETED AND BRAZED PLATE HEAT EXCHANGERS, Marko S. Jarić[1], Nikola J. Budimir[1], Ivan M. Rakonjac[2], Stevan J. Budimir[3],** *[1] Innovation Center of the Faculty of Mechanical Engineering, Kraljice Marije 16, 11000 Belgrade, Serbia; [2] Project Management College, Bože Jankovića 14, 11000 Belgrade, Serbia; [3] Institute Goša, Milana Rakića 35, 11000 Belgrade, Serbia;*

Time	Hall 211 (Second floor)
11:00-13:00	**TQM 2015 / Session 17 - Closing Plenary Session: TQM & QM New Dimensions** **Chairmen Session:** **Prof. Dr. Stanislav Karapetrovic,** *University of Alberta, Department of Mechanical Engineering, Edmonton, Canada.* **Prof. Dr. Lidia P. Galabova,** *Department of Economics, Industrial Engineering and Management, Technical University of Sofia, 8 Kliment Ohridski Blvd., Sofia 1000, Bulgaria.* **Prof. Dr. Kristina Zgodavova,** *Technical University of Kosice, Faculty of Metallurgy, Department of Integrated Management, Letna 9, Kosice, SK-04200,Slovakia.* **Prof. Dr. Dragan Djurdjanovic**, *Department of Mechanical Engineering, University of Texas, Austin, TX, USA.* **Prof. Dr.-Ing. R. Refflinghaus,** *University of Kassel, Institut für Arbeitswissenschaft und Prozessmanagement (IfA), Fachgebiet Qualitäts- und Prozessmanagement , Heinrich-Plett-Str. 40, D-34132 Kassel, Germany;* **Prof. Dr. Mirko Sokovic,** *Faculty of Mechanical Engineering, University of Ljubljana, Askerceva 6, SI-1000 Ljubljana, Slovenia;* **Prof. Dr. Vesna Spasojević Brkić,** *University of Belgrade, Faculty of Mechanical Engineering, Industrial Engineering Department, KraljiceMarije 16, 11000 Belgrade, Serbia;* **Živorad Belić,** *FIAT Serbia, Kragujevac, Serbia;* **Keynote Speakers:** 1. **TQM & BE, Prof. Dr. Stanislav Karapetrovic,** *University of Alberta, Department of Mechanical Engineering, Edmonton, Canada.* 2. **TOWARDS BUSINESS EXCELLENCE: *KNOWLEDGE MANAGEMENT AND SIX SIGMA*, Lidia P. Galabova [1], Boyka G. Nenkova [2]** , *[1]Department of Economics, Industrial Engineering and Management, Technical University of Sofia, 8 Kliment Ohridski Blvd., Sofia 1000, Bulgaria, [2] GCR Ltd., 10 Vihren Str., 1618 Sofia, Bulgaria.* 3. **JOURNEY OF SLOVAK ORGANISATIONS PROVIDING SERVICES TOWARDS EXCELLENCE**, **Kristina Zgodavova**, *Technical University of Kosice, Faculty of Metallurgy, Department of Integrated Management, Letna 9, Kosice, SK-04200,Slovakia.* 4. **VIRTUAL METROLOGY CONCEPT FOR PREDICTING DEFECT LEVELS IN SEMICONDUCTOR MANUFACTURING, Asad Ul Haw, Dragan Djurdjanovic**, *Department of Mechanical Engineering, University of Texas, Austin, TX, USA.* 5. **TOLERANCE MANAGEMENT IN THE BODY CONSTRUCTION ENVIRONMENT AS A BASE FOR THE CONFORMITY OF THE PRODUCTS WITH THEIR SPECIFICATION, Prof. Dr.-Ing. R. Refflinghaus[1], Dipl.-Ing. M. Roth, M.Sc. J. Witte[2],** *[1]University of Kassel, Institut für Arbeitswissenschaft und Prozessmanagement (IfA), Fachgebiet Qualitäts- und Prozessmanagement , Heinrich-Plett-Str. 40, D-34132 Kassel, Germany; [2]BMW Group München, Germany.* 6. **40 INVENTIVE PRINCIPLES OF TRIZ, Matej Hohnjec**, *3ZEN d.o.o., Tacenska 125B, SI-1000 Ljubljana, Slovenia;* **Mirko Sokovic,** *Faculty of Mechanical Engineering, University of Ljubljana,*

	Askerceva 6, SI-1000 Ljubljana, Slovenia; 7. **EMPLOYEES FACTORS AS PREDICTOR AND RESPONSE VARIABLES OF LEAN SIX SIGMA CONCEPT, Spasojević Brkić V.[1)], Tomić B.[2)],** [1)] *University of Belgrade, Faculty of Mechanical Engineering, Industrial Engineering Department, KraljiceMarije 16, 11000 Belgrade, Serbia;* [2)] *Bombardier Aerospace, Quality Management, 123 Garratt Boulevard, Toronto, Canada.* 8. **DETERMINING THE CAUSE FOR VARIABLE GEOMETRY OF THE PART OF BODY IN WHITE AND PROVIDING SOLUTIONS, Živorad Belić[1], Vidosav Majstorović[2],** [1)] *FIAT Serbia, Kragujevac; University of Belgrade, Mechanical Engineering Faculty, Belgrade;*

13:00 – 14.00 TQM 2015 / Farewell Cocktails in Club CeNT (first level)

The 8th IWC TQM CONFERENCE PROGRAM

***Date:* 5th June, 2015 / Friday**		***Place: Lola Institute, Belgrade.***
08.00-12:00	***TQM 2015* / Excursion tour – *Lola Institute* (www.li.rs).** For details please contact: jusk@eunet.rs, as soon as possible, because number of participants are limited (min 30, max 50). Host of excursion tour is Lola Institure, Belgrade.	

Welcome in Belgrade on the 8th IWC TQM 2015 !

Contents:

MANUFACTURING COSTS OF GASKETED AND BRAZED PLATE HEAT EXCHANGERS

UDC: 629.036.7;

Marko S. Jarić 1, Nikola J. Budimir 1, Ivan M. Rakonjac 2, Stevan J. Budimir 3

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Paper received: 25.02.2015.; Paper accepted: 12.03.2015.

Abstract: *The paper deals with the investment costs for gasketed and brazed plate heat exchangers. The most common correlations for estimating prices of this types heat exchangers found in open literature were tested using the market data for a comparison and they have shown significant deviations. A new correlation for calculating prices of stainless steel gasketed plate and frame heat exchangers was determined in the form:* $C_{in} = 1584 \cdot S_{hts}^{0.516}$, *while a new correlation for calculating prices of stainless steel brazed apparatus was determined in the following form:* $C_{in} = 832 \cdot S_{hts}^{0.637}$

Key words: *plate and frame heat exchangers, correlation, manufacturing costs*

1. INTRODUCTION

The earliest development of plate heat exchangers (PHEs) was for milk pasteurization, which involved heating the milk to a certain temperature, and holding it at this temperature for a short time and then immediately cooling it. This process requires the heat transfer equipment to be thermally very efficient and, most importantly, be cleaned easily. It was difficult to meet these operational requirements in most of the early heat transfer equipment that were used for pasteurization of milk, and this led to the development of PHEs.

Plate heat exchangers were not commercially exploited until the 1920s, as PhD Richard Seligman, the founder of APV International in England, invented the first operational PHE (plate pasteurizer) in 1923. Almost a decade later, Bergedorfer, Eisenwerk of Alfa Laval in Sweden (AB Separator at that time) developed a similar commercial PHE.

The first ever Finnish plate heat exchanger was delivered to Säteri Oy, Valkeakoski for a solution heater. This unit was manufactured in Sweden in the late 1920s [1], [2]. Plate heat exchangers can generally be classified as: gasketed plate heat exchangers, brazed (welded) heat exchangers and semi-brazed (welded) heat exchangers.

A gasketed plate heat exchanger consists of a series of thin corrugated plates fitted with gaskets that separate the fluids. A typical gasketed plate heat exchanger is the plate-and frame heat exchanger shown in Fig. 1. The plates come with corner parts arranged so that the two media, between which heat is exchanged, flow through alternate channel spaces.

Appropriate design and gasketing permit a stack of plates to be held together by compression bolts joining the end plates. Gaskets prevent leakage to the outside and allow the inter-plate channels to be sealed and to direct the fluids into alternate channels, ensuring the two media never mix. The operation of gasketed plate heat exchangers are constrained by the operating temperature (-40 °C up to 180 °C) and pressure (~25÷30 bar) limits [3], [4], [5].

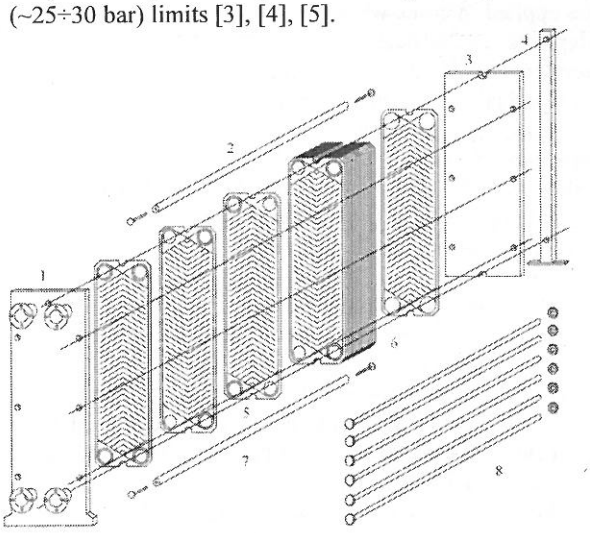

Figure1. Gasketed plate and frame heat exchanger: 1-fixed support, 2-beam for centering the plates, 3-moveable support, 4-support, 5-plate with the gasket, 6-package of plates, 7-supporting beam, 8-anker bolts

There is a large number of materials that are used as gaskets at plate and frame heat exchangers, but in this paper we were limit only to those materials that are commonly used in thermotechnics and chemical engineering. These gaskets materials together with their maximum operate temperature are shown in

Table 1[6].

Table 1: The most common used gaskets materials

No.	Material	The most commonly used name	Temperature limit, °C
1	Styrene-Butadiene	Buna-S	85
2	Neoprene	Neoprene	120
3	Acrylonitrile-Butadiene	Buna-N	135
4	Ethylene/Propylene	EPDM	150
5	Fluorocarbon	Viton	150
6	Resin-Cured Butyl	Resin-Cured Butyl	150
7	Compressed Asbestos	Compressed Asbestos	260

The special feature of this type of plate heat exchanger is their flexible constructions admit the heat transfer plates to be removed easily for cleaning, inspection or maintenance accessibility. Moreover, heat transfer plates can also be added or rearranged to meet new process conditions [2].

Brazed (welded) plate heat exchangers are produced by making the connection between the plates by process welding or brazing. Figure 2 presents the basic elements of brazed plate heat exchangers. Considering that there is no caps, gaskets and bolts, apparatuses of this type are cheaper than other type of plate heat exchangers, but can't be applied in cases where the working fluids tend to form deposits on the heat transfer surface. These apparatuses are characterized by low mass and small volume in comparison to the heat transfer surface. Temperature of working fluid is from -160 °C to 400 °C and range of operating pressures is from deep vacuum up to 40 bar, while today's new testing methods allow brazed units to operate up to 60 bar pressure conditions.

Typically application is for heating and cooling in process and other industries (for example cooling of hydraulic oil) and also in thermotechnics (heating and cooling in the field of air conditioning evaporation and condensation at cooling systems, heat pumps, etc...). In terms of maintenance, the brazed plate units cannot disassemble for cleaning of the addition of heat transfer plates as gasketed units can. If cleaning is required it can be cleaned chemically [7], [8].

Semi-brazed (welded) design means that the packet plates formed by pairs of welded or brazed plate between them are placed gasket. Considering to development in the area of plate and frame heat exchangers based on gasketed plate heat exchanger and brazed (welded) heat exchangers, semi-brazed (welded) apparatuses are now days rarely used [7].

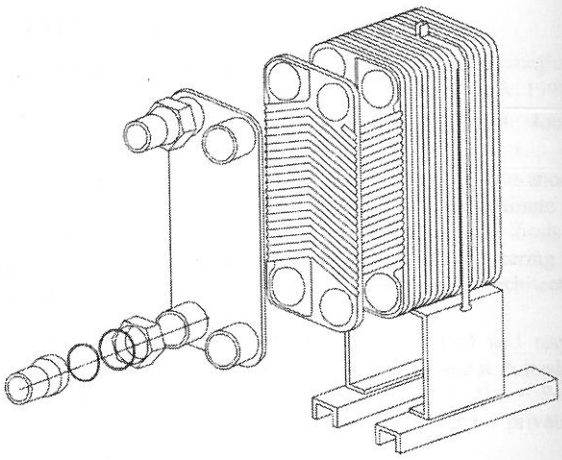

Figure 2. Brazed plate and frame heat exchanger 1-support, 2-the front plate, 3-plate, 4-package of plates, 5-jack

Although the afore mentioned apparatuses have been used in process industries and thermotechnics for almost a century, problems to their investment and maintenance costs have not be fully explored until this very day. Taking this into consideration, the primary objective of this paper was to determine the investment cost of gasketed and brazed plate heat exchangers. These costs in general case include: costs of materials for apparatus, energy, labour and other costs.

2. CALCULATION PRICE OF HEAT EXCHANGERS

We can find only several correlations for estimating cost of plate and frame heat exchangers in the open literature. They are based on knowledge of the design of the apparatus, the operating pressure, design temperature, the heat transfer surface, the material the apparatus is made of, etc. The most often cited correlations are listed in Table 2, where they are not given in its original form, but are adjusted in order for the price to be expressed in an appropriate manner (in this case EUR2014 month June).

Prices of apparatuses must be translate also from the year in which they were built (Table 3) in the year for which the analysis is done. The simplest method which is used to translate the price takes into account the increasing costs due to market trends and the cost is given by next equation:

$$C_B = C_A \cdot (I_B / I_A) \quad (1)$$

where:

C_A, EUR, price of apparatus at the moment A,
C_B, EUR, price of apparatus at the moment B,
I_A, index of price at the moment A,
I_B, index of price at the moment B [9], [10], [11].

Table 2: Correlations for price estimation of plate and frame heat exchangers by various authors

No.	Year	Material (Plate and frame)	Temp. range (°C)	Pressure range (bar)	S_{hts} range (m^2)	Correlation for estimation prices from literature	Type of apparatus	Ref.	Eq.
1	1990	Titanium-Titanium*	-	-	-	$C_{in} = 1875 \cdot S_{hts}^{0.778}$	-	[12]	(2)
2	1990	Stainless steel-Carbon steel*	-	-	-	$C_{in} = 855 \cdot S_{hts}^{0.778}$	-	[12]	(3)
3	1992	-	-	-	0.1÷1.9	$C_{in} = 654 \cdot S_{hts}^{0.578}$	brazed	[13]	(4)
4	1992	-	-	-	0.4÷18.5	$C_{in} = 2136 \cdot S_{hts}^{0.279}$	gasketed	[13]	(5)
5	1995	-	-	-	4.65÷836	$C_{in} = 262 \cdot S_{hts}^{0.639}$	-	[14]	(6)
6	1996	Stainless steel	10÷130	-	0.14÷1.9	$C_{in} = 462 \cdot S_{hts}^{0.354}$	brazed	[6]	(7)
7	1996	Stainless steel-Stainless steel	10÷130	-	2.33÷61	$C_{in} = 1135 \cdot S_{hts}^{0.485}$	gasketed	[6]	(8)
8	2002	Stainless steel-Stainless steel	20÷160	1÷10	0.5÷19	$C_{in} = 386 \cdot S_{hts}^{0.489}$	gasketed	[15]	(9)
9	2002	Titanium – Titanium	20÷160	1÷10	0.5÷19	$C_{in} = 589 \cdot S_{hts}^{0.463}$	gasketed	[15]	(10)
10	2002	Stainless steel-Stainless steel	20÷160	1÷10	>19	$C_{in} = 131 \cdot S_{hts}^{0.691}$	gasketed	[15]	(11)
11	2002	Titanium-Titanium	20÷160	1÷10	>19	$C_{in} = 126 \cdot S_{hts}^{0.751}$	gasketed	[15]	(12)
12	2004	-	-	-	5÷100	$C_{in} = 626 \cdot S_{hts}^{0.636}$	gasketed	[16]	(13)
13	2009	Stainless steel-Stainless steel	20÷120	-	17.8÷245	$C_{in} = 295 \cdot S_{hts}^{0.595}$	gasketed	[17]	(14)

Table 3: Prices of gasketed plate heat exchangers

No.	Year built	Material (Plate and frame)	S_{hts}, m^2	Cost of apparatus in year built (dollar)	Cost of apparatus ($EUR_{June2014}$)
1	1996	Stainless steel-Stainless steel	2.38	1736	3087
2	1996	Stainless steel-Stainless steel	4.78	2036	3621
3	2013	Stainless steel-Stainless steel	6.31	5365	4105
4	1996	Stainless steel-Stainless steel	9.48	2754	4899
5	1996	Stainless steel-Stainless steel	14.12	3359	5974
6	1996	Stainless steel-Stainless steel	18.67	3920	6971
7	1996	Stainless steel-Stainless steel	24.71	4841	8610
8	2009	Stainless steel-Stainless steel	28.9	7396	6628
9	2009	Stainless steel-Stainless steel	31.5	7998	7167
10	1996	Stainless steel-Stainless steel	34.28	5683	10107
11	1996	Stainless steel-Stainless steel	38.28	5809	10332
12	1996	Stainless steel-Stainless steel	43.57	6754	12012
13	1996	Stainless steel-Stainless steel	46.82	7106	12639
14	2009	Stainless steel-Stainless steel	49.6	11395	10211
15	1996	Stainless steel-Stainless steel	55.46	7701	13698
16	1996	Stainless steel-Stainless steel	61.22	7051	12541
17	2013	Stainless steel-Stainless steel	70.21	20005	15307
18	2013	Stainless steel-Stainless steel	95.26	23924	18305
19	2013	Stainless steel-Stainless steel	145.81	27455	21007
20	2013	Stainless steel-Stainless steel	205.59	32823	25115
21	2009	Stainless steel-Stainless steel	245	34835	31216

Table 4: Prices of brazed plate heat exchangers

No.	Year built	Material of brazed plate heat exchangers	Material used for brazing	S_{hts}, m^2	Cost of apparatus in year built ($)	Cost of apparatus (€, June2014)
1	2013	Stainless steel 316L	Copper	0.12	310	236
2	1996	Stainless steel 316L	Copper	0.14	228	277
3	2013	Stainless steel 316L	Copper	0.23	378	288
4	1996	Stainless steel 316L	Copper	0.33	367	447
5	2013	Stainless steel 316L	Copper	0.35	570	434
6	2013	Stainless steel 316L	Copper	0.47	636	484
7	2013	Stainless steel 316L	Copper	0.52	656	499
8	1996	Stainless steel 316L	Copper	0.70	516	627
9	2013	Stainless steel 316L	Copper	0.78	902	686
10	2013	Stainless steel 316L	Copper	1.04	1297	987
11	2013	Stainless steel 316L	Copper	1.31	1384	1053
12	1996	Stainless steel 316L	Copper	1.39	901	1097
13	2013	Stainless steel 316L	Copper	1.57	1737	1322
14	1996	Stainless steel 316L	Copper	1.86	1349	1641
15	2013	Stainless steel 316L	Copper	2.96	2185	1663
16	2013	Stainless steel 316L	Copper	3.95	2130	1621
17	2013	Stainless steel 316L	Copper	4.93	2491	1896
18	2013	Stainless steel 316L	Copper	6.00	2779	2115
19	2013	Stainless steel 316L	Copper	7.89	3423	2468
20	2013	Stainless steel 316L	Copper	9.87	3689	2808
21	2013	Stainless steel 316L	Copper	12.00	4088	3196
22	2013	Stainless steel 316L	Copper	53.00	16560	12948
23	2013	Stainless steel 316L	Copper	54.40	16807	13141
24	2013	Stainless steel 316L	Copper	61.80	18560	14512

3. ANALYSIS OF INVESTMENTS COSTS OF GASKETED PLATE AND FRAME HEAT EXCHANGERS

In this paper, we conducted an analysis the goal of which was to determine to what extent the discrepancies arose when using the existing equations $(2 \div 14)$. Deviation in prices calculated using the correlation $2 \div 14$ and the actual price of apparatuses (Euro2014, month June) is expressed using the following statistical indicators.

This statistical parameters are expressed as follows:

- correlation ratio (CR)

$$\theta = \sqrt{1 - \frac{\sum_{i=1}^{n}\left(C_{in} - C_{in,pred}\right)^2}{\sum_{i=1}^{n}\left(C_{in} - C_{in,sr}\right)^2}} \tag{15}$$

- root-mean square deviation (RMSD),

$$\Delta_{av} = \sqrt{\frac{\sum_{i=1}^{n}\left(\frac{C_{in} - C_{in,pred}}{C_{in,ave}}\right)^2}{n}} \tag{16}$$

where:

- $C_{inv,av}$ the mean value of dependent variable
- C_{inv}, for n experimental values of price

$$C_{inv,av} = \frac{\sum_{i=1}^{n} C_{in,i}}{n} \tag{17}$$

- n, number of experimental sistemated pairs.

The analysis proved that these correlations show significant deviations and that they cannot be successfully used to describe the manufacturing costs for the mentioned type of plate and frame heat exchangers (a gasketed plate and frame heat exchanger, where these apparatus are made of stainless steel and gaskets materials is Acrylonitrile-Butadiene). Deviations in using above mentioned correlations are shown in Table 5. Therefore, on the basis of the data given in Table 3 (price for 2014 year month June), a new correlation was found in the following form:

$$C_{in} = 1584 \cdot S_{hts}^{0.516} \tag{18}$$

for range 2.38 m^2<S_{hts}<245 m^2, 2<p<24 bar, 15<T<120 °C.

Its statistical parameters are CR=0.9817 and RMSD=12.71%. This established correlation is also shown on Figure 3.

Also analysis proved that these correlations show significant deviations and that they cannot be

successfully used to describe the manufacturing costs for brazed heat exchanger, where these apparatus are made of stainless steel 316L). Deviations in using above mentioned correlations are shown in Table 4. Therefore, on the basis of the data given in Table (price for 2014 year month June), a new correlation was found in the following form:

$$C_{in} = 832 \cdot S_{hts}^{0.637} \quad (19)$$

to girth: 0.12 m^2<S_{hts}<61.8 m^2, 3<p<24 bar, 5<145 °C
Its statistical parameters are CR=0.9707 and RMSD=16.84%. This established correlation is also shown on Figure 4.

Table 5: Statistical parameters of the literature correlations

No.	Year	Material	Temp. range (°C)	Pressure range (bar)	S_{hts} range (m^2)	Correlation	Ref.	*CR*	*RMSD*	Eq.
1	1990	Titanium – Titanium*	-	-	-	$C_{in} = 1875 \cdot S_{hts}^{0.778}$	[12]	0	228.10	(2)
2	1990	Stainless steel – Carbon steel*	-	-	-	$C_{in} = 855 \cdot S_{hts}^{0.778}$	[12]	0	57.81	(3)
3	1992	-	-	-	0.1÷1.9	$C_{in} = 654 \cdot S_{hts}^{0.578}$	[13]	0.4139	48.82	(4)
4	1992	-	-	-	0.4÷18.5	$C_{in} = 2136 \cdot S_{hts}^{0.279}$	[13]	0	42.56	(5)
5	1995	-	-	-	4.65÷836	$C_{in} = 262 \cdot S_{hts}^{0.639}$	[14]	0	74.31	(6)
6	1996	Stainless steel	-	-	0.14÷1.9	$C_{in} = 462 \cdot S_{hts}^{0.354}$	[6]	0	83.16	(7)
7	1996	Stainless steel –Stainless steel	-	-	2.33÷61	$C_{in} = 1135 \cdot S_{hts}^{0.485}$	[6]	0.6177	36.13	(8)
8	2002	Stainless steel –Stainless steel	20÷160	1÷10	0.5÷19	$C_{in} = 386 \cdot S_{hts}^{0.489}$	[15]	0	77.75	(9)
9	2002	Titanium – Titanium	20÷160	1÷10	0.5÷19	$C_{in} = 589 \cdot S_{hts}^{0.463}$	[15]	0	69.02	(10)
10	2002	Stainless steel –Stainless steel	20÷160	1÷10	>19	$C_{in} = 131 \cdot S_{hts}^{0.691}$	[15]	0	84.43	(11)
11	2002	Titanium – Titanium	20÷160	1÷10	>19	$C_{in} = 126 \cdot S_{hts}^{0.751}$	[15]	0	81.32	(12)
12	2004	-	-	-	5÷100	$C_{in} = 626 \cdot S_{hts}^{0.636}$	[16]	0.7488	40.34	(13)
13	2009	Stainless steel –Stainless steel	-	-	17.8÷245	$C_{in} = 295 \cdot S_{hts}^{0.595}$	[17]	0	75.30	(14)

Table 6: Statistical parameters of the literature correlations

No.	Year	Material	Temp. range (°C)	Pressure range (bar)	S_{hts} range (m^2)	Correlation	Ref.	*CR*	*RMSD*	Eq.
1	1990	Titanium – Titanium*	-	-	-	$C_{in} = 1875 \cdot S_{hts}^{0.778}$	[12]	0	177.71	(2)
2	1990	Stainless steel – Carbon steel*	-	-	-	$C_{in} = 855 \cdot S_{hts}^{0.778}$	[12]	0.8229	40.20	(3)
3	1992	-	-	-	0.1÷1.9	$C_{in} = 654 \cdot S_{hts}^{0.578}$	[13]	0.8114	27.07	(4)
4	1992	-	-	-	0.4÷18.5	$C_{in} = 2136 \cdot S_{hts}^{0.279}$	[13]	0.7564	190.29	(5)
5	1995	-	-	-	4.65÷836	$C_{in} = 262 \cdot S_{hts}^{0.639}$	[14]	0.4635	68.32	(6)
6	1996	Stainless steel	-	-	0.14÷1.9	$C_{in} = 462 \cdot S_{hts}^{0.354}$	[6]	0	53.67	(7)
7	1996	Stainless steel –Stainless steel	-	-	2.33÷61	$C_{in} = 1135 \cdot S_{hts}^{0.485}$	[6]	0.8781	44.27	(8)
8	2002	Stainless steel –Stainless steel	20÷160	1÷10	0.5÷19	$C_{in} = 386 \cdot S_{hts}^{0.489}$	[15]	0.3465	57.59	(9)
9	2002	Titanium – Titanium	20÷160	1÷10	0.5÷19	$C_{in} = 589 \cdot S_{hts}^{0.463}$	[15]	0.5433	39.17	(10)
10	2002	Stainless steel –Stainless steel	20÷160	1÷10	>19	$C_{in} = 131 \cdot S_{hts}^{0.691}$	[15]	0	83.45	(11)
11	2002	Titanium – Titanium	20÷160	1÷10	>19	$C_{in} = 126 \cdot S_{hts}^{0.751}$	[15]	0.2491	83.20	(12)
12	2004	-	-	-	5÷100	$C_{in} = 626 \cdot S_{hts}^{0.636}$	[16]	0.8856	27.08	(13)
13	2009	Stainless steel –Stainless steel	-	-	17.8÷245	$C_{in} = 295 \cdot S_{hts}^{0.595}$	[17]	0.4335	65.30	(14)

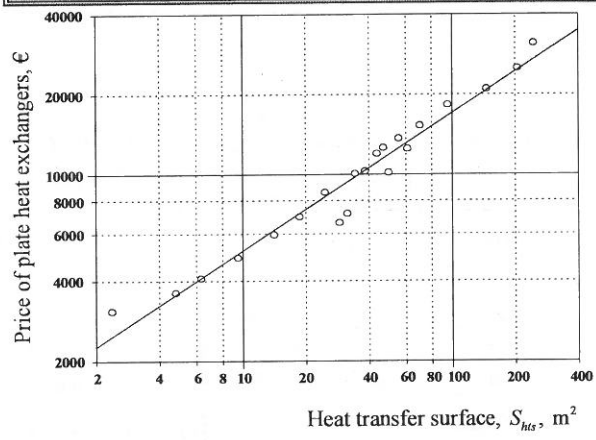

Figure3. Manufacturing costs for gasketed apparatus versus to heat transfer surface

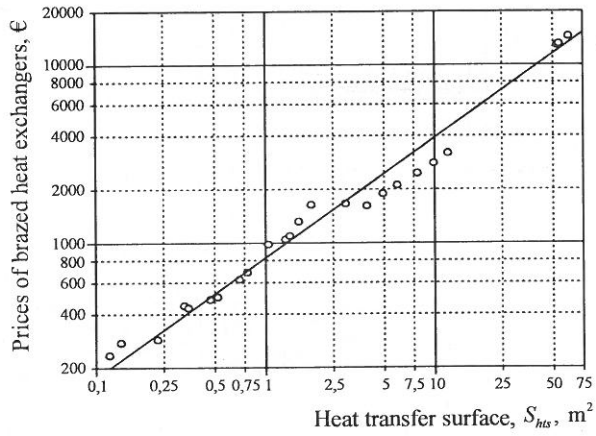

Figure 4 Manufacturing costs of brazed apparatus versus to heat transfer surface

4. CONCLUSION

The paper presents the main types of plate heat exchangers and manufacturing costs of gasketed and brazed plate heat exchangers. The cost analysis was conducted using data (price) from literature and price obtained from the manufacturer for this types of heat exchangers.

After examining the correlations currently found in the existing body of literature on investment costs of gasketed plate and frame heat exchangers, it was concluded that a new correlation needs to be found. The new equation for calculations costs (price) of stainless steel gasketed plate and frame heat exchangers with Acrylonitrile-Butadiene as gaskets materials has the following form:

$$C_{in} = 1584 \cdot S_{hts}^{0.516}, \text{ EUR} \qquad (18)$$

for range $2.38 < S_{hts} < 245$, m², $2 < p < 24$ bar, $15 < T < 120$ °C and also shown on Figure 3. The statistical parameters of this equation are CR=0.9817, and RMSD=12.71%.

On the other hand, the new correlation for estimation manufacturing costs (price) of stainless steel 316L brazed plate heat exchangers (when used the copper as brazing material) has established in the following form:

$$C_{in} = 832 \cdot S_{hts}^{0.637} \qquad (19)$$

for range: 0.12 m² $< S_{hts} <$ 61.8 m², $3 < p < 24$ bar, $5 < T < 145$ °C and also shown on Figure 4. The statistical parameters of this equation are CR=0.9707, and RMSD=16.84%

ACKNOWLEDGMENT

We thank the Ministry of Education and Science of Serbia for a partial support to this study through the Project of Technology Development.

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Nomenclature

C_A, EUR, price of apparatus at the moment A;
C_B, EUR, price of apparatus at the moment B;
C_{in}, EUR, investment cost of heat exchanger (price of manufactured apparatus);
$C_{in,i}$, EUR, investment cost of heat exchanger i;
$C_{in,ave}$, EUR, the mean value of dependent variable C_{in}, for n experimental values;
I_A, index of price at the moment A;
I_B, index of price at the moment B;
n, number of experimental values;
p, bar, operating pressure;
S_{hts}, m^2, heat transfer surface;
T, °C, operating temperature;
Greek letters
Δ_{av}, %, root-mean square deviation (RMSD);
Θ, correlation ratio (CR)

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TQM Conference Schedule:
Sessions based on accepted papers on the topics of interest. Special sessions/Conferences organized and chaired by internationally recognized leaders of research in advanced topics. RTDs/WSs on special topics.

TQM Conference Venue

The TQM Conference will be held at the capital city of Belgrade, Serbia.

Official Language

The official language of the TQM Conference is English.

Scope of the TQM Conference

The main objective of the 7th TQM Conference is to provide an *international forum around the world for the exchange of knowledge, experience, research results and information* about various aspects of the state-of-the-art and the future development of total quality management.

The *scope* of the Conference covers *philosophical, scientific and practical concepts concerning research, development and application* of TQM-based advanced approaches.

Topics of interest

Topics of interest include, but are *not limited* to:

- *Business excellence models (applications and development trends);*
- *TQM & manufacturing management;*
- *World class performance;*
- *Attractive quality;*
- *Robust engineering;*
- *Six sigma model;*
- *Intelligent quality tools and methods;*
- *Virtual factory and virtual quality;*
- *Intelligent metrology in manufacturing;*
- *Intelligent and virtual CMM;*
- *Business process improvement;*
- *Breakthrough management;*
- *Organizational Excellence;*
- *Intelligent design for quality;*
- *Intelligent Business;*
- *Quality in Higher Education;*
- *Quality of the Public Services / health care;*
- *Advanced Quality approaches;*
- *Digital engineering/manufacturing;*
- Manufuture initiative *and Micro-nano manufacturing / Metrology*

Special Session dedicated to Ph. D. thesis

A special session will be dedicated to discussion of Ph. D. Thesis. An international committee will assign an award to the best paper from Ph. D. Thesis.

Papers and Proceedings

Prospective authors are invited to send their contributions on relevant topics. Papers may be submitted by e-mail in a Word file. The length of the paper should be 8A4 pages; 1.0 space typing; use Arial 10 point font. For the anonymity of review; please identify the following information separately: *the title; author's full name; affiliation; address; e-mail address; telephone and fax numbers.* Authors of accepted papers will be expected to sign a copyright release allowing publication in the proceedings. Pre - proceedings will be available before the Conference.

After the Conference, the Proceedings with selected the best papers which will under a second review, RTD, panel discussion and conclusion will be published in a Special Issue of the TQM Journal - ISSN: 1754-2731 (Emerald).

Registration

The registration fee for the TQM Conference is Euro 150; if paid before 15th May 2017. After that date; the fee is Euro 200. For the registration fee please contact the Conference Secretariat.

Lodging

For details regarding hotel reservations please contact the Conference Secretariat.

Important dates:

January 15; 2017 – Proposal for special sessions and RTDs/WSs due, Summary.

February 25; 2017 – Full paper due; 8 pages; electronic submission.

March 15; 2017 – Final paper acceptance.

March 25; 2017 – Registration announcement.

April 25; 2017– Final program announcement.

May 15; 2017 – Early registration deadline.

5th – 9th June – International Working Conference.

Conference Program Agenda – Draft:

First Day – 1st June 2017. / Industrial tour / *Evening* – Welcome reception and **ROUND TABLE DISSCUSION.**

Second Day – 2nd June *2017.* / 10:00a.m. – Noon Opening and Key Note Speakers. Cocktail / noon - 2:00p.m. Parallel Sessions (1) / 4:00 – 7:00p.m. Panel Discussion – Research Directions / Evening – Informal Conference Dinner.

Third/Fourth Day – 3rd / 4th June *2017.* / 10:00a.m. – Noon Parallel Sessions (2) / 12.30p.m. – 2:00p.m. Parallel Sessions (3) / 4:00p.m. – 7:00p.m. Parallel Sessions (4).

Fifth Day – 5th June *2017.* / 10:00a.m. - Noon Closing Plenary Session.

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The Eighth International Working Conference

Total Quality Management - Advanced and Intelligent Approaches

Publisher:

Mechanical Engineering Faculty, Laboratory for Production metrology and TQM, Belgrade, Serbia.

Editor:

Prof. Dr. Vidosav D. Majstorović
Mechanical Engineering Faculty, Kraljice Marije 16, 11020 Beograd, Serbia.

Editorial Office:

Kneza Miloša 9/I, 11000 Belgrade, Serbia.
Phone: 011/3236266
Fax: 011/3236266
E-mail: jusk@eunet.rs
Web: www.jusk.rs
All the manuscripts are not to be returned.

For publisher:

Jelena Mačužić, M.Sc.

Note:

Publication of this Proceedings is supported by the Ministry of Education and Science of the Republic of Serbia.

Printed by:

Faculty of Technical Sciences, Graphic Engineering and Design
Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia.
Phone: 021/4852621
Fax: 021/4852628
Web: www.grid.uns.ac.rs

ISBN: 978-86-7083-858-1

Circulation: 500.

Belgrade, May 2015.

ISBN 978-86-7083-858-1