University of Banja Luka
Faculty of Mechanical Engineering

# 11th International Conference on Accomplishments in Electrical and Mechanical Engineering and Information Technology DEMI 2013

# PROCEEDINGS

DEMI 2013

Banja Luka
30th May – 1th June 2013


# PROCEEDINGS

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# 11th INTERNATIONAL CONFERENCE ON ACCOMPLISHMENTS IN ELECTRICAL MECHANICAL ENGINEERING AND INFORMATION TECHNOLOGY

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**Content**

## KEYNOTE LECTURES



## MECHANICS AND DESIGN

**PRODUCTION TECHNOLOGIES AND ENGINEERING**

**ENERGY AND THERMAL ENGINEERING**

**TRANSPORT AND MEANS OF TRANSPORT**

**MECHATRONICS**

**MAINTENANCE OF TECHNICAL SYSTEMS, OCCUPATIONAL SAFETY**

## PREFACE

Dear colleagues,
DEMI Conference has brought us together for the 11th time to show the current state of research in the field of Mechanical and Electrical Engineering as well as Information Technology.

From the very beginning, the Conference has aimed strengthening cooperation between companies and science. However, we live at the time of a severe economic crisis that even affects the richest economies. Furthermore, stagnation of the real economy and unemployment are present in technologically developed countries, whereas investments in the R&D sector are small, all of which reflects on the field of scientific research.

There was concern that such a state of the economy may cause a lack of interest and potential of scientific workers to participate actively in the work of scientific conferences. However, DEMI will not flinch. With great pleasure, I would like to point out that the DEMI 2013 Conference gathered a record number of participants so far. The Conference Proceedings contains 174 papers by authors from 14 countries. Scientists and researchers have traditionally been the most active in the field of Production Technology and Engineering (41 papers), followed by Energy and Thermal Engineering (37 papers), Mechanics and Design (28 papers), Transport Vehicles and Transportation (23 papers), Mechatronics (20 papers), Maintenance of technical systems, Occupational safety (17 papers).

On behalf of Organizational Board of the 11th International Conference on Accomplishments in Electrical and Mechanical Engineering and Information Technology, DEMI 2013, I wish all our guests a warm welcome to Banja Luka and successful work to all participants. Furthermore, I would like to express my gratitude to all the authors, members of the Scientific Committee, institutions, companies and individuals who have contributed to successful organization of the DEMI 2013 Conference.

In Banja Luka, May 2013
Chair of DEMI 2013 Organizational Board
Valentina Golubović-Bugarski

## PREDGOVOR

Poštovane kolege,
Konferencija DEMI okupila nas je po 11. put da prezentujemo trenutno stanje istraživanja u području mašinstva, elektrotehnike i informacionih tehnologija.

Konferencija DEMI odavno je za svoj cilj postavila jačanje oblika saradnje između privrednih preduzeća i nauke. Međutim, živimo u vrijeme teške ekonomske krize koja pogađa i najbogatije ekonomije, stagnacija realne privrede i nezaposlenost prisutni su i u tehnološki najrazvijenijim zemljama, ulaganja u razvoj i istraživanja su mala, što se sve reflektuje i na područje naučnih istraživanja.

Postojala je bojazan da će ovakvo stanje privrede uzrokovati i manjak interesovanja i mogućnosti naučnih radnika da aktivno učestvuju u radu naučnih konferencija. Ipak, DEMI ne posustaje.

S posebnim zadovoljstvom ističem da je Konferencija DEMI 2013 okupila do sada rekordan broj učesnika. U zborniku radova objavljeno je 174 radova autora iz 14 zemalja. Naučnici i istraživači tradicionalno su najaktivniji u području Proizvodnih tehnologija i inženjerstva, a rezultati istraživanja u ovom području saopšteni su kroz 41 radova. Slijede područje Termotehnike i energetike (37 radova), Mehanika i konstrukcije (28 rada), Saobraćaj i transportna sredstva (23 rada), Mehatronika (20 radova) i Održavanje tehničkih sistema i zaštita na radu (17 radova).

U ime Organizacionog odbora Konferencije DEMI 2013 iskazujem svim našim gostima toplu dobrodošlicu u Banju Luku i želim uspješan rad učesnicima Konferencije. Takođe, zahvaljujem se svim autorima, članovima Naučnog odbora, institucijama, firmama i pojedincima koji su svojim angažovanjem doprinijeli da Konferencija DEMI 2013 bude uspješno organizovana.

U Banjoj Luci, maj 2013. godine
Predsjednik Organizacionog odbora
Konferencije DEMI 2013
Valentina Golubović-Bugarski


# ECOLOGICAL AND ENERGY ENGINE CHARACTERISTICS WHEN THE ENGINE APPLIES DIFFERENT WORKING PROCESSES

**Radivoje Pešić[1], Aleksandar Davinić[2], DraganTaranović[3]**

***Summary:*** *Multi-process working principle is one of the modern approaches to development of internal combustion engines. By the combination of the original features of the OTO and diesel working processes can be achieved improving ecological and energy characteristics of the engine. Examples for that are spark ignition engine with stratified charge and compression ignition engines with homogeneous charge (HCCI). For the implementation of basic research in this field was implemented experimental Multi-process engine and was developed its testing methodology. This paper presents the results of the combination of OTO / DIESEL working processes when the engine working with both conventional and bio-fuels.*
***Keywords:*** *compression ratio, efficiency, emission, experimental engine, working process*

## 1. INTRODUCTION

It is known that the way the engine working process is running has a dominant influence on the engine efficiency and emission. The formation of flammable mixture, its homogeneity and composition, its way of ignition and the course of combustion process, as well as load control mode are the main characteristics of the working process (Table 1). Classical concepts of OTTO and Diesel engines are conditioned by the properties of the used fuel and they have generic advantages and disadvantages. Modern technologies of engine equipment have allowed synthesis of the good features of traditional working processes.

Thus, spark ignition of very lean inhomogeneous mixture, reduction of pump losses at low loads and increase of the compression ratio is enabled in gasoline direct injection engine (GDI) with stratified charge, thanks to the internal formation of mixture. In this way, engine efficiency at low and moderate loads is much-improved [5]. At medium and high-loads, working process is conducted by OTTO cycle. However, DIESEL attributes of the working process have brought their shortcomings: the sensitivity of the process of mixture forming to the change of the flow in the chamber (misfiring) and particulate emission.

[1] Radivoje Pešić, Ph.D., full prof., Faculty of Engineering, University of Kragujevac, pesicr@kg.ac.rs
[2] Aleksandar Davinić, MSc., Assistant, Faculty of Engineering, University of Kragujevac, davinic@kg.ac.rs
[3] Dragan Taranović, Ph.D., Assistant, Faculty of Engineering, University of Kragujevac, tara@kg.ac.rs