



University of Novi Sad  
FACULTY OF TECHNICAL SCIENCES  
DEPARTMENT OF PRODUCTION ENGINEERING  
21000 NOVI SAD, Trg Dositeja Obradovica 6, SERBIA



---

UDK 621

ISSN 1821-4932

**JOURNAL OF**  
**PRODUCTION ENGINEERING**

---

Volume 17

Number 1

Novi Sad, June 2014

*Publisher:* FACULTY OF TECHNICAL SCIENCES  
DEPARTMENT OF PRODUCTION ENGINEERING  
21000 NOVI SAD, Trg Dositeja Obradovica 6  
SERBIA

---

*Editor-in-chief:* Dr. Pavel Kovač, Professor, Serbia

*Reviewers:* Dr. Janko HODOLIČ, Professor, Serbia  
Dr. Marin GOSTIMIROVIĆ, Professor, Serbia  
Dr. František HOLEŠOVSKY, Professor, Czech Republic  
Dr. Janez KOPAČ, Professor, Slovenia  
Dr. Pavel KOVAČ, Professor, Serbia  
Dr. Mikolaj KUZINOVSKI, Professor, Macedonia  
Dr. Ildiko MANKOVA, Professor, Slovak Republic  
Dr. Snežana RADONJIĆ, Professor, Serbia  
Dr. Branko ŠKORIĆ, Professor, Serbia  
Dr. Ljubomir ŠOOŠ, Professor., Slovak Republic  
Dr. Wojciech ZEBALA, Professor, Poland  
Dr. Miodrag HADŽISTEVIĆ, Assoc. Professor, Serbia  
Dr. Slobodan TABAKOVIĆ, Assoc. Professor, Serbia  
Dr. Đorđe VUKELIĆ, Assist. Professor, Serbia

*Technical treatment and design:* M.Sc. Borislav Savković, Assistant

*Manuscript submitted for publication:* June 22, 2014.

*Printing:* 1<sup>st</sup>

*Circulation:* 300 copies

*CIP classification:*

*Printing by: FTN, Graphic Center  
GRID, Novi Sad*

**ISSN: 1821-4932**

CIP – Каталогизacija u publikaciji  
Библиотека Матице српске, Нови Сад

621

JOURNAL of Production Engineering / editor in chief  
Pavel Kovač. – Vol. 12, No. 1 (2009)- . – Novi Sad :  
Faculty of Technical Sciences, Department for Production  
Engineering, 2009-. – 30 cm

Dva puta godišnje (2012-). Je nastavak: Časopis proizvodno  
mašinstvo = ISSN  
0354-6446  
ISSN 1821-4932

## INTERNATIONAL EDITORIAL BOARD

---

*Dr. Joze BALIĆ, Professor, Slovenia*  
*Dr. Marian BORZAN, Professor, Romania*  
*Dr. Konstantin BOUZAKIS, Professor, Greece*  
*Dr. Miran BREZOČNIK, Professor, Slovenia*  
*Dr. Ilija ČOSIĆ, Professor, Serbia*  
*Dr. Pantelija DAKIĆ, Professor, Bosnia and Herzegovina*  
*Dr. Numan DURAKBASA, Professor, Austria*  
*Dr. Katarina GERIĆ, Professor, Serbia*  
*Dr. Marin GOSTIMIROVIĆ, Professor, Serbia*  
*Dr. Janko HODOLIČ, Professor, Serbia*  
*Dr. František HOLEŠOVSKY, Professor, Czech Republic*  
*Dr. Juliana JAVOROVA, Professor, Bulgaria*  
*Dr. Vid JOVIŠEVIĆ, Professor, Bosnia and Herzegovina*  
*Dr. Janez KOPAČ, Professor, Slovenia*  
*Dr. Borut KOSEC, Professor, Slovenia*  
*Dr. Mikolaj KUZINOVSKI, Professor, Macedonia*  
*Dr. Miodrag LAZIĆ, Professor, Serbia*  
*Dr. Stanislaw LEGUTKO, Professor, Poland*  
*Dr. Chusak LIMSAKUL, Professor, Thailand*  
*Dr. Vidosav MAJSTOROVIC, Professor, Serbia*  
*Dr. Ildiko MANKOVA, Professor, Slovak Republic*  
*Dr. Mirko SOKOVIĆ, Professor, Slovenia*  
*Dr. Antun STOIĆ, Professor, Croatia*  
*Dr. Peter SUGAR, Professor, Slovak Republic*  
*Dr. Katica ŠIMUNOVIĆ, Professor, Croatia*  
*Dr. Branko ŠKORIĆ, Professor, Serbia*  
*Dr. Ljubomir ŠOOŠ, Professor, Slovak Republic*  
*Dr. Ljubodrag TANOVIĆ, Professor, Serbia*  
*Dr. Wiktor TARANENKO, Professor, Ukraine*  
*Dr. Marian TOLNAY, Professor, Slovak Republic*  
*Dr. Gyula VARGA, Professor, Hungary*  
*Dr. Milan ZELJKOVIĆ, Professor, Serbia*  
*Dr. Miodrag HADŽISTEVIĆ, Assoc. Professor, Serbia*  
*Dr. Milenko SEKULIĆ, Assoc. Professor, Serbia*  
*Dr. Aco ANTIĆ, Assist. Professor, Serbia*  
*Dr. Sebastian BALOŠ, Assist. Professor, Serbia*  
*Dr. Igor BUDAK, Assist. Professor, Serbia*  
*Dr. Arkadiusz GOLA, Assist. Professor, Poland*  
*Dr. Ognjan LUŽANIN, Assist. Professor, Serbia*  
*Dr. Mijodrag MILOŠEVIĆ, Assist. Professor, Serbia*  
*Dr. Slobodan TABAKOVIĆ, Assist. Professor, Serbia*  
*Dr. Đorđe VUKELIĆ, Assist. Professor, Serbia*

### *Editorial*

*The **Journal of Production Engineering** dates back to 1984, when the first issue of the **Proceedings of the Institute of Production Engineering** was published in order to present its accomplishments. In 1994, after a decade of successful publication, the Proceedings changed the name into *Production Engineering*, with a basic idea of becoming a Yugoslav journal which publishes original scientific papers in this area.*

*In 2009 year, our Journal finally acquires its present title - **Journal of Production Engineering**. To meet the Ministry requirements for becoming an international journal, a new international editorial board was formed of renowned domestic and foreign scientists, refereeing is now international, while the papers are published exclusively in English. From the year 2011 Journal is in the data base COBISS and KoBSON presented.*

*The Journal is distributed to a large number of recipients home and abroad, and is also open to foreign authors. In this way we wanted to heighten the quality of papers and at the same time alleviate the lack of reputable international and domestic journals in this area.*

*In this journal are published, reviewed papers from International Conference "ETIKUM 2014" which was in Novi Sad, Serbia and certain number of new scientific papers as well.*

*Editor in Chief*

*Professor Pavel Kovač, PhD,*