



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 22

Number 1

Novi Sad, June 2019

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

Technical treatment and design: Dr. Borislav Savković, Assist. Professor

Manuscript submitted for publication: June 30, 2019.

Printing: 1st

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 ĆOSIĆ, Professor, Serbia
Dr. Numan DURAKBASA, Professor, Austria
Dr. Leposava ŠIĐANIN, Professor emeritus, Serbia
Dr. Dušan GOLUBOVIĆ, Professor, Bosnia and Herzegovina
Dr. Marin GOSTIMIROVIĆ, Professor, Serbia
Dr. Miodrag HADŽISTEVIĆ, Professor, Serbia
Dr. František HOLEŠOVSKY, Professor, Czech Republic
Dr. Juliana JAVOROVA, Professor, Bulgaria
Dr. Janez KOPAČ, Professor, Slovenia
Dr. Borut KOSEC, Professor, Slovenia
Dr. Leon KUKIELKA, Professor, Poland
Dr. Janos KUNDRAK, Professor, Hungary
Dr. Mikolaj KUZINOVSKI, Professor, Macedonia
Dr. Stanislaw LEGUTKO, Professor, Poland
Dr. Chusak LIMSAKUL, Professor, Thailand
Dr. Vidosav MAJSTOROVIĆ, Professor, Serbia
Dr. Ildiko MANKOVA, Professor, Slovak Republic
Dr. Bogdan NEDIĆ, Professor, Serbia
Dr. Miroslav RADOVANOVIĆ, Professor, Serbia
Dr. Mircea RISTEIU, Professor, Romania
Dr. Milenko SEKULIĆ, Professor, Serbia
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. Slobodan TABAKOVIĆ, Professor, Serbia
Dr. Branko TADIĆ, Professor, Serbia
Dr. Ljubodrag TANOVIĆ, Professor, Serbia
Dr. Marian TOLNAY, Professor, Slovak Republic
Dr. Gyula VARGA, Professor, Hungary
Dr. Wojciech ZEBALA, Professor, Poland
Dr. Milan ZELJKOVIĆ, Professor, Serbia
Dr. Aco ANTIĆ, Assoc. Professor, Serbia
Dr. Sebastian BALOŠ, Assoc. Professor, Serbia
Dr. Igor BUDAK, Assoc. Professor, Serbia
Dr. Dejan LUKIĆ, Assoc. Professor, Serbia
Dr. Ognjan LUŽANIN, Assoc. Professor, Serbia
Dr. Mijodrag MILOŠEVIĆ, Assoc. Professor, Serbia
Dr. Tatjana STANIVUK, Assoc. Professor, Croatia
Dr. Đorđe VUKELIĆ, Assoc. Professor, Serbia
Dr. Arkadiusz GOLA, Assist. Professor, Poland
Dr. Liska KATALIN, Assist. Professor, Hungary
Dr. Dragan RAJNOVIĆ, Assist. Professor, Serbia
Dr. Borislav SAVKOVIĆ, 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 Google scholar, 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 "MMA 2018" which was in Novi Sad, Serbia and certain number of new scientific papers as well.

Editor in Chief

Professor Pavel Kovač, PhD.