

UNIVERSITY OF NIŠ
FACULTY OF OCCUPATIONAL SAFETY



Journal for Scientists and Engineers
SAFETY ENGINEERING

Naučno stručni časopis
INŽENJERSTVO ZAŠTITE

Vol. 6. №1 (2016)

Niš, June 2016

Scientific Journal

SAFETY ENGINEERING

Naučni časopis

INŽENJERSTVO ZAŠTITE

(OPEN ACCESS JOURNAL - www.safety.ni.ac.rs)

Izдавач / Publisher

Fakultet zaštite na radu u Nišu / Faculty of Occupational Safety in Niš

Glavni urednik / Editor-in-Chief

Dejan Krstić

Urednici / Editors

Ivan Krstić

Srđan Glišović

Vesna Nikolić

Redakcijski odbor / Editorial Board (in alphabetical order)

Andres Carrnion Garcia, Technical University of Valencia, Spain

Boris Đindić, University of Niš, Faculty of Medicine, Serbia

Branislav Anđelković, University of Niš, Faculty of Occupational Safety, Serbia

Dejan Petković, University of Niš, Faculty of Occupational Safety, Serbia

Đordje Čosić, University of Novi Sad, Faculty of Technical Studies, Serbia

Dragan Mitić, University of Niš, Faculty of Occupational Safety, Serbia

Dragan Mlađan, The Academy of Criminalistic and Police Studies, Serbia

Dusan Sakulski, Faculty of Natural and Agricultural Sciences, DiMTEC, Bloemfontein, South Africa

Dušan Sokolović, University of Niš, Faculty of Medicine, Serbia

Goran Ristić, University of Niš, Faculty of Electronic Engineering, Serbia

Ivana Banković Ilić, University of Niš, Faculty of Technology in Leskovac, Serbia

Joseph Aronov, VNIIS Mosow, Russia

Jovica Jovanović, University of Niš, Faculty of Medicine, Serbia

Katarína Senderská, Technical University of Košice, Faculty of Mechanical Engineering, Slovakia

Kemal Nuri Özerkan, University of Istanbul, School of Physical Education Sports

Ljiljana Živković, University of Niš, Faculty of Occupational Safety, Serbia

Ljubiša Papić, University of Kragujevac, Technical Faculty Čačak, Serbia

Miloš Jelić, Institute Kirilo Savić, Serbia

Miomir Stanković, University of Niš, Faculty of Occupational Safety, Serbia

Mirjana Vidanović, University of Niš, Faculty of Occupational Safety, Serbia

Mirko Marić, University of Primorska, Faculty of Management, Slovenia

Nevenka Kopjar, University of Zagreb, Institute for Medical Research and Occupational Health, Croatia

Nenad Živković, University of Niš, Faculty of Occupational Safety, Serbia

Nenad Cvetković, University of Niš, Faculty of Electronic Engineering, Serbia

Noam Lior, University of Pennsylvania, USA

Predrag Petrović, Institute Kirilo Savić, Beograd, Serbia

Rodoljub Simović, Vinca Institute of Nuclear Sciences, Serbia

Susana San Matias, Technical University of Valencia, Spain

Suzana Savić, University of Niš, Faculty of Occupational Safety, Serbia

Slavoljub Aleksić, University of Niš, Faculty of Electronic Engineering, Serbia

Vera Marković, University of Niš, Faculty of Electronic Engineering, Serbia

Vlada Veljković, University of Niš, Faculty of Technology in Leskovac, Serbia

Wolfgang Mathis, Institut für Theoretische Elektrotechnik, Hannover, Germany

Zoran Keković, University of Belgrade, Faculty of Security Studies, Serbia

Žarko Janković, University of Niš, Faculty of Occupational Safety, Serbia

Tehnički urednik / Technical Editor

Rodoljub Avramović

Lektor / Proofreading

Nataša Šelmić-Milosavljević

Aleksandra Petković

Časopis izlazi tromesečno / The journal is published quarterly

Štampa / Press

M KOPS Centar



From Editor's desk

“We never know the worth of water till the well is dry”
Thomas Fuller, 1732

Hereby, in front of our readership is a new issue of Safety Engineering, a journal that is steadily growing in scope and content. This time, we rely mostly on domestic authors from various fields of research, but we declare our commitment to foster international profile of Safety Engineering since the foreign papers are keep coming for review. Therefore we urge our foreign colleagues and researchers to timely submit their manuscripts, and thus spread their findings through our open access journal. We are certain that the journal should continue to reflect the safety issues in their broadest sense, and preserve its interdisciplinary scope. This time, along with technology related papers, we include a couple of relevant research from chemistry and biology that fall in scope of environmental safety issues. The journal welcomes research articles, condensed reviews, as well other research forms that fit in the format of our publication. The board of editors would certainly appreciate any feedback, from readers and authors alike, since a constructive criticism could help us to preserve and improve the quality of the journal.

„Nikada ne shvatamo vrednost vode, dok izvor ne presuši“
Tomas Fuler, 1732.

Pred našim čitaocima je novi broj Inženjerstva zaštite, časopisa koji i dalje raste po opsegu i sadržaju. Ovog puta se uglavnom oslanjamo na domaće autore koji deluju u različitim područjima istraživanja, ali i potvrđujemo svoju posvećenost podsticanju međunarodnog profila časopisa, budući da radovi stranih autora konstantno dospevaju na recenzije. Zbog toga, pozivamo naše strane kolege-istraživače da pravovremeno dostavljaju svoje rukopise, i na taj način svoja otkrića učine dostupnim širem krugu čitalaca koji prate naš časopis u otvorenom pristupu. Sigurni smo da ova publikacija treba i nadalje da obuhvata probleme zaštite i bezbednosti u najširem smislu, i da očuva svoj interdisciplinarni karakter.

Ovaj broj, pored radova koji se odnose na različite segmente tehnike i tehnologije, sadrži i nekoliko relevantnih istraživanja iz hemije i biologije, koja takođe spadaju u delokrug zaštite životne sredine. Časopis pozdravlja dostavljanje istraživačkih radova, kratkih preglednih radova, kao i drugih istraživačkih oblika koji se uklapaju u format naše publikacije. Uredništvo će svakako posebno ceniti bilo kakve povratne informacije, kako čitaoca, tako i autora, jer nam konstruktivna kritika može pomoći da očuvamo i poboljšamo kvalitet časopisa.

On behalf of Editorial team,
Prof. Dr. Srdjan Glišović