

**PROCEEDINGS OF PAPERS**

**Zbornik radova**

**(Ic)ETLAN 2019**

6th International Conference on Electrical, Electronic and Computing  
Engineering

in conjunction with

**ETLAN**

63rd National Conference on Electrical, Electronic and Computing  
Engineering

**Proceedings of Papers** – 6th International Conference on Electrical, Electronic and Computing Engineering, IcETLAN 2019, Silver Lake, Serbia, June 03 – 06, 2019

**Zbornik radova** - 63. Konferencija za elektroniku, telekomunikacije, računarstvo, automatiku i nuklearnu tehniku, Srebrno jezero, 03 – 06. juna, 2019. godine

*Main Editor / Glavni urednik*

**Dejan Popović**

*Editors / Urednici*

**Slobodan Vukosavić, Boris Lončar**

*Published by / ETRAN Society, Belgrade, Academic Mind, Belgrade*

*Izdavači / Društvo za ETRAN, Beograd i Akademska misao, Beograd*

*Production / Izrada*

**Academic Mind, Belgrade / Akademska misao, Beograd**

*Place and year of publication / Mesto i godina izdanja*

**Belgrade, 2019. / Beograd, 2019.**

*Circulation / Tiraž*

**200 primeraka / 200 copies**

**ISBN 978-86-7466-785-9**

**[www.etrans.rs](http://www.etrans.rs)**

## ORGANIZERS

**ETTRAN Society, Belgrade,  
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia  
School of Electrical Engineering, University of Belgrade.**

Conferences were organized under the auspices of Ministry of Education, Science and Technological Development of the Republic of Serbia with the support of IEEE – Institute of Electrical and Electronics Engineers, USA and technical support of Academic MInd, Serbia.

### ORGANIZING COMMITTEE ICETTRAN 2019

#### *Chair*

Prof. Boris Loncar, Faculty of Technology and Metallurgy, Belgrade (Serbia)

#### *Vice-chair*

Prof. Slobodan Vukosavić, corresponding member SASA, Faculty of Electrical Engineering, Belgrade (Serbia)

#### *Members*

Prof. Boban Veselić, Faculty of Electronic Engineering, Niš (Serbia)

Prof. Milica Janković, Faculty of Electrical Engineering, Belgrade (Serbia)

Prof. Miroslav Lutovac, The Academy of Engineering Sciences of Serbia (AESS), Belgrade (Serbia)

Prof. Dragan Mančić, Faculty of Electronic Engineering, Niš (Serbia)

Prof. Vera Marković, Faculty of Electronic Engineering, Niš (Serbia)

Prof. Ivan Milentijević, Faculty of Electronic Engineering, Niš (Serbia)

Prof. Milan Milosavljević, Singidunum University, Belgrade (Serbia)

PhD Dragana Nikolić, Institute Vinča, Belgrade (Serbia)

Prof. Zorica Nikolić, Faculty of Electronic Engineering, Niš (Serbia)

Prof. Vesna Paunović, Faculty of Electronic Engineering, Niš (Serbia)

Prof. Tatjana Pešić-Brđanin, University of Banja Luka (Bosnia and Hertzegovina)

Prof. Miroslav Popović, Faculty of Technical Science, Novi Sad (Serbia)

Prof. Aneta Prijić, Faculty of Electronic Engineering, Niš (Serbia)

Prof. Milan Rapaić, vice-chair, Faculty of Technical Science, Novi Sad (Serbia)

PhD Aleksandar Rodić, Full Research Professor, Institut Mihajlo Pupin, Belgrade (Serbia)

Prof. Marko Rosić, Faculty of Technical Sciences, Čačak (Serbia)

Prof. Lazar Saranovac, Faculty of Electrical Engineering, Belgrade (Serbia)

Prof. Aleksandra Smiljanić, Faculty of Electrical Engineering, Belgrade (Serbia)

Prof. Platon Sovilj, Faculty of Technical Sciences, Novi Sad (Serbia)

Prof. Petar Spalević, Faculty of technical Sciences, Kosovska Mitrovica (Serbia)

Assist. prof. Kovilja Stanković, Faculty of Electrical Engineering, Belgrade (Serbia)

Assist. prof. Miodrag Tasić, Faculty of Electrical Engineering, Belgrade (Serbia)  
Prof. Dejan Ćirić, Faculty of Electronic Engineering, Niš (Serbia)

---

### **Support to promotion of the awarded papers**

Prof. Milić Đekić  
Faculty of Technical Sciences, Čačak (Serbia)

---

### **Local Organizing Committee of IcETran 2018**

Antonijević Dunja, University of Belgrade, Serbia  
Dimović Slavko, University of Belgrade, Serbia  
Marković Maja, University of Belgrade, Serbia  
Miljojić Tatjana, University of Belgrade, Serbia  
Pešić Ivan, University of Belgrade, Serbia  
Radisavljević Anđela, University of Belgrade, Serbia  
Rubinjoni Luka, University of Belgrade, Serbia  
Ugrinović Vukašin, University of Belgrade, Serbia

---

### **Program and Technical support**

Mirjana Jovanić, ETRAN  
Zlatko Jarnević, ETRAN  
Marko Vujadinović, Academic Mind, Belgrade  
Aleksandar Rašković, Academic mind, Belgrade  
Boban Milijić, Academic mind, Belgrade

---

This volume contains the papers presented at , 6th International Conference on Electrical, Electronic and Computing , (Ic)ETLAN 2019 in conjunction of ETRAN 63rd National Conference on Electrical, Electronic and Computing Engineering held on June 3-6, 2019 in Veliko Gradište.

There were 247 submissions. Each submission was reviewed by at least 1, and on the average 2, reviewers. The committee decided to accept papers as follows. Invited papers are included and presented as papers in Sessions.

During the Conferences were held three Special Sessions:

- **Special Session dedicated to academician Rajko Tomović**

Moderators:

Academician SASA Dejan Popović, Professor Emeritus Srđan Stanković and Prof. Srbijanka Turajlić

- **Special Session: New Materials**

Moderators:

Corresponding member SASA Velimir Radmilović: **Decoupling of Electrical and Thermal Properties in Nanostructured Materials;**

Prof. Vladimir Srdić: **Ultrafast Spin Dynamics in Multiferroic Oxides;**

Prof. Petar Uskoković: **Synthesis and Supercapacitive performances of Electrospun Carbon Nanofibers Decorated with Spinel  $\text{Co}_{1.5}\text{Mn}_{1.5}\text{O}_4$  Nanocrystals**

- **Special Session: Centers of Excellence**

Moderators:

Corresponding Member SASA Branislav Jelenković, **Center of Excellence: Photonics Center at the Institute of Physics**

Prof. Đorđe Janačković, **Centre of Research Excellence: Nanotechnology and Functional Materials Centre**

Dr Branko Matović, **Center of Excellence: Multifunctional Materials Centre at the "Vinča" Institute for Nuclear Sciences**

August 27, 2019

Belgrade

Boris Loncar

**PROCEEDINGS OF PAPERS**

**Zbornik radova**

**(Ic)ETRAN 2019**

6th International Conference on Electrical, Electronic and Computing  
Engineering

in conjunction with

**ETRAN**

63rd National Conference on Electrical, Electronic and Computing  
Engineering

**MICRO ELECTROMECHANICAL SYSTEMS (MEMS) BASED MICROFLUIDIC  
PLATFORMS  
(INVITED PAPER)**

*Dana Vasiljević-Radović, ICTM CMT, University of Belgrade, Serbia*  
*Milena Rašljić, ICTM CMT, University of Belgrade, Serbia*  
*Milče Smiljanić, ICTM CMT, University of Belgrade, Serbia*  
*Žarko Lazić, ICTM CMT, University of Belgrade, Serbia*  
*Katarina Radulović, ICTM CMT, University of Belgrade, Serbia*  
*Katarina Cvetanović-Zobenica, ICTM CMT, University of Belgrade, Serbia*

**ABSTRACT**

In this work an overview of Micro Electromechanical Systems (MEMS)-based microfluidic platforms for different applications is presented. Microfluidics refers to a set of technologies that control the flow of liquids or gases through miniaturized systems in typical amounts of nano- and pico- liters. Microfluidic devices are characterized by microchannels with characteristic dimensions in the micrometer range. The main techniques, technologies and materials used for fabrication of MEMS microfluidic devices and systems are presented. The used materials and their properties are very important for the final characteristics and functionalities of devices. As an example, the design and fabrication of our opto-fluidic lab-on-a-chip device based on silicon and pyrex glass is given.