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# 2022 IEEE XVIII$^{th}$ International Conference on the Perspective Technologies and Methods in MEMS Design (MEMSTECH)

# Proceedings

**Lviv Polytechnic National University, UKRAINE**

**IEEE Ukraine Section (West) MTT/ED/AP/EP/SSC Societies Joint Chapter**

# 2022 IEEE XVIII$^{th}$ International Conference on the Perspective Technologies and Methods in MEMS Design (MEMSTECH)

# PROCEEDINGS

**Polyana, September 7-11, 2022**


Lviv, 2022

*Organized by:*

**CAD Department of Lviv Polytechnic National University, Ukraine**
**Wroclaw University of Science and Technology, Poland**
**AGH University of Science and Technology, Poland**
**IEEE Ukraine Section**
**IEEE Ukraine Section IE/PE/PEL Joint Chapter**
**IEEE Ukraine Section (West) MTT/ED/AP/EP/SSC Societies Joint Chapter**

*Technical Co-Sponsors:*

**Lviv Polytechnic National University**
**IEEE Ukraine Section**
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**PROCEEDINGS**

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# PREFACE

Welcome to XVIII th International Conference "PERSPECTIVE TECHNOLOGIES AND METHODS IN MEMS DESIGN" – MEMSTECH 2022, which is organized by Lviv Polytechnic National University, CAD Department, IEEE Ukraine Section, IEEE Ukraine Section IE/PE/PEL Joint Chapter, IEEE Ukraine Section (West) MTT/ED/AP/EP/SSC Societies Joint Chapter, Wroclaw University of Science and Technology, Poland, and AGH University of Science and Technology, Poland.

During the past decade, a series of new fabrication techniques has been evolved which helped to popularize microelectromechanical systems (MEMS), and numerous novel devices have been reported in the various areas of engineering and science. The interdisciplinary nature of MEMS utilizes design, engineering and manufacturing expertise from a wide range of technical areas including the integrated circuit fabrication technology, mechanical engineering, materials science, electrical engineering, chemistry and chemical engineering, as well as the fluid engineering, optics, instrumentation and packaging.

MEMSTECH Conference is intended to provide a possibility to discuss the problems of design, modeling, analysis, optimization, and model's development of microdevices among scientists from the different countries. To achieve this goal, various aspects of the advanced microelectronic design, testing and manufacturing will be presented within the framework of 12 major topics:

- Devices ranging in size from microns to millimeters;
- Micro actuators;
- Micro robots;
- Micro batteries;
- New materials and designs for MEMS;
- IC-compatible fabrication techniques;
- Other fabrication techniques;
- Measurement of micro phenomena;
- Theoretical results;
- Electrical interconnections;
- Micro telemanipulation, and standards appropriate to MEMS;
- Application examples and application oriented devices in fluidics, optics and bio-medical engineering.

The papers cover different areas of design, analysis, simulation and testing of microsystems as well as power devices. Following our tradition, the dialogue on training and technology transfer as well as education and teaching experience in the domain of mixed design and application of integrated circuits will be continued.

Over 70 submissions have been evaluated by the Program Committee to put together a high quality of papers accepted for the oral presentations. The organizers would like to thank to all the distinguished scientists who have supported the conference by taking part in the International Program Committee and reviewing the contributed papers.

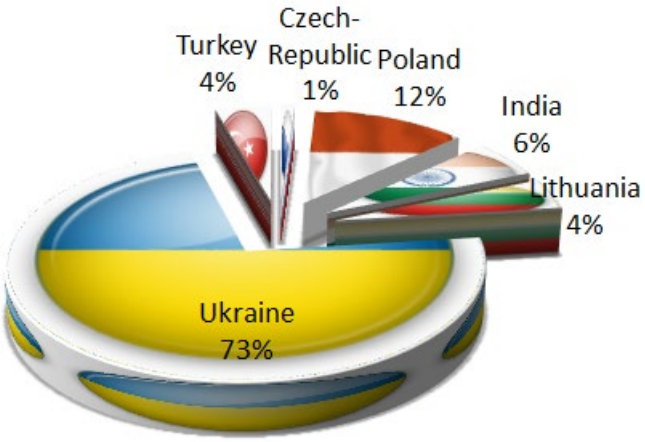
**Number of authors and co-authors**

| Country: | Number of authors: |
|---|---|
| Czech-Republic | 1 |
| India | 5 |
| Lithuania | 4 |
| Poland | 11 |
| Turkey | 4 |
| Ukraine | 66 |
| **Total** | **91** |

**Number of Submissions by Country**

| Country: | Number of papers: |
|---|---|
| Czech-Republic | 1 |
| India | 2 |
| Lithuania | 2 |
| Poland | 2 |
| Turkey | 1 |
| Ukraine | 17 |
| **Total** | **25** |

**Number of authors and co-authors**




As can be seen from the paper statistics, the total number of authors and co-authors appearing in all the papers is 91. It should be underlined that some papers are joint for two or even three institutions involved in the project.

Due to Russia's military aggression against Ukraine MEMSTECH'2022 Organizing Committee has taken a decision to host a virtual conference this year. This is a new challenge for all of us and we want to thank all participants who have submitted their papers, as well as invited speakers who have kindly agreed to deliver their presentations at MEMSTECH'2022.

We hope that the Conference will help to establish fruitful cooperation between scientists and different expertise area representatives, as well as will help all the participating Universities in elaborating the optimal curriculum for students involved in microsystems design.

Information about the Conference is posted online at **http://memstech.ieee.org.ua/**

We look forward to seeing you again and thank you for your continuing support and participation.

*Lviv, September 2022*

*Mykhaylo Melnyk*
*CAD Department*
*Lviv Polytechnic National University, Ukraine*
*Chairperson of MEMSTECH 2022*

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# Index of Authors

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# CONTENTS