

Preface

In 2020, the International Conference on Industrial Engineering (ICIE) was held on 18-22 of May. The spread of the coronavirus COVID-19 made adjustments to our lives that year, including the organization of the ICIE conference. ICIE was held as a virtual conference. Both oral sections and poster sections were organized on-line. Oral sections were implemented as a video conference. Poster sections were in a chat mode.

The conference organizers were South Ural State University (national research university), Platov South-Russian State Polytechnic University, Moscow Polytechnic University, and Volgograd State Technical University.

The conference was organized in 13 sections, including:

Part 1. Mechanical Engineering (Machinery and Mechanism Design; Dynamics of Machines and Working Processes; Friction, Wear, and Lubrication in Machines; Design and Manufacturing Engineering of Industrial Facilities; Transport and Technological Machines; Mechanical Treatment of Materials; Industrial Hydraulic Systems; Green Manufacturing);

Part 2. Materials Engineering and Technologies for Production and Processing (Polymers, Composites and Ceramics; Steels and Alloys, Metallurgical and Metalworking Technologies; Chemical and Hydrometallurgical Technologies; Surface Engineering and Coatings; Processing and Controlling Technologies).

The program committee selected more than 500 reports for participating in the conference. Scientists and practitioners from 18 countries took part in the conference, including representatives of 83 Russian cities from the western and central parts to the Far East regions. International participants represented 43 cities and 17 countries.

The organizing committee would like to express our sincere appreciation to everybody who has contributed to the conference. Heartfelt thanks are due to authors, reviewers, participants, and to all the team of organizers for their support and enthusiasm, which granted success to the conference.

Conference Chair, prof. Andrey A. Radionov.

Conference Committee

Conference Chair

Prof. Radionov A.A., Vice-Rector of the South Ural State University (National Research University), Chelyabinsk, Russia

Program Co-Chair

Prof. Kravchenko O.A., Vice-Rector of the Platov South-Russian State Polytechnic University (Novocherkassk Polytechnic Institute), Novocherkassk, Russia

Prof. Borovin Yu.M., Vice-Rector of the Moscow Polytechnic University, Moscow, Russia

Prof. Navrotsky A.V., Vice-Rector of the Volgograd State Technical University, Volgograd, Russia

International Program Committee

Prof. Ambartsumyants R.V., Odessa National Academy of Food Technologies, Odessa, Ukraine

Prof. Anuchin A.S., National Research University "Moscow Power Engineering Institute", Moscow, Russia

Prof. Bashkansky Emil, ORT Braude College of Engineering, Karmiel, Israel

Prof. Bepalov V.Ya., National Research University "Moscow Power Engineering Institute", Moscow, Russia

Prof. Bigeev V.A., Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia

Prof. Bochkarev I.V., Kyrgyz State Technical University after I. Razzakov, Bishkek, Kyrgyz Republic

Prof. Braslavskiy I.Ya., Ural Federal University named after the first President of Russia B.N. Yeltsin, Ekaterinburg, Russia

Prof. Brovanov S.V., Novosibirsk State Technical University, Novosibirsk, Russia

Prof. Bukreev V.G., Tomsk Polytechnic University, Tomsk, Russia

Prof. Cabrita Carlos Manuel Pereira, University of Beira Interior, Covilha, Portugal

Prof. Cardoso Antonio J. Marques, University of Beira Interior, Covilha, Portugal

Prof. Cernat Mihai, Transilvania University of Brasov, Brasov, Romania

Prof. Chidurala Srinivas, Jawaharlal Nehru Technological University Hyderabad, Telangana, India

Prof. Chigirinskiy Yu.L., Volgograd State Technical University, Volgograd, Russia

Prof. Colak Ilhami, Nisantasi University, Istanbul, Turkey

Prof. Dementiev Yu.N., Tomsk Polytechnic University, Tomsk, Russia

Prof. Dibrov I.A., Moscow Polytechnic University, Moscow, Russia

Prof. Dimitrov L.V., Technical University of Sofia, Sofia, Bulgaria

Prof. Dobrov I.V., National Metallurgical Academy of Ukraine, Dnepropetrovsk, Ukraine

Prof. Dorofeev Yu.G., Platov South-Russian State Polytechnic University (Novocherkassk Polytechnic Institute), Novocherkassk, Russia

Prof. Dyakonov A.A., South Ural State University (National Research University), Chelyabinsk

Prof. Erkki Lahderanta, Lappeenranta University of Technology, Lappeenranta, Finland

Prof. Gandzha S.A., South Ural State University (National Research University), Chelyabinsk, Russia

Prof. Gasanov B.G., Platov South-Russian State Polytechnic University (Novocherkassk Polytechnic Institute), Novocherkassk, Russia

Prof. Geychuk V.N., National Technical University of Ukraine "Kyiv Polytechnic Institute", Kyiv, Ukraine

Prof. Gorbatenko N.I., Platov South-Russian State Polytechnic University (Novocherkassk Polytechnic Institute), Novocherkassk, Russia

Prof. Gurevich L.M., Volgograd State Technical University, Volgograd, Russia

Prof. Guzeyev V.I., South Ural State University (National Research University), Chelyabinsk

Prof. Haritonov S.A., Novosibirsk State Technical University, Novosibirsk, Russia
Prof. Hramshin V.R., Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia
Prof. Isakov V.S., Platov South-Russian State Polytechnic University (Novocherkassk Polytechnic Institute), Novocherkassk
Prof. Johann Walter Kolar, Swiss Federal Institute of Technology, Zurich, Switzerland
Prof. Kalashnikov A.S., Moscow Polytechnic University, Moscow, Russia
Prof. Karali Patra, Indian Institute of Technology Patna, Patna, India
Prof. Karandaev A.S., Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia
Prof. Kazarinov L.S., South Ural State University (National Research University), Chelyabinsk, Russia
Prof. Kondakov A.I., Bauman Moscow State Technical University (National Research University), Moscow, Russia
Prof. Kravets A.G., Volgograd State Technical University, Volgograd, Russia
Prof. Krasnovskiy B.M., National Research University Higher School of Economics, Moscow
Prof. Lipkin M.S., Platov South-Russian State Polytechnic University (Novocherkassk Polytechnic Institute), Novocherkassk, Russia
Prof. Maloletov A.V., Volgograd State Technical University, Volgograd, Russia
Prof. Morgunov Yu.A., Moscow Polytechnic University, Moscow, Russia
Prof. Pavese Franco, National Institute for Research in Metrology, Torino, Italy
Prof. Pinchuk V.A., Lugansk, Ukraine
Prof. Pyatibratov G.Ya., Platov South-Russian State Polytechnic University (Novocherkassk Polytechnic Institute), Novocherkassk, Russia
Prof. Qin Hongwu, Changchun University, China
Prof. Radev Khristo, Technical University of Sofia, Sofia, Bulgaria
Prof. Rachkov M.Yu., Moscow Polytechnic University, Moscow, Russia
Prof. Rainer Niewa, Institut für Anorganische Chemie Universität Stuttgart, Stuttgart, Germany
Prof. Rozhdestvenskiy Yu.V., South Ural State University (National Research University), Chelyabinsk
Prof. Rushan Ziatdinov, Keimyung University, Daegu, South Korea
Prof. Ryszard Strzelecki, Gdynia Maritime University, Gdynia, Poland
Prof. Saushkin B.P., Moscow Polytechnic University, Moscow, Russia
Prof. Serdobintsev Yu.P., Volgograd State Technical University, Volgograd, Russia
Prof. Shlyapin A.D., Moscow Polytechnic University, Moscow, Russia
Prof. Skvortsov A.A., Moscow Polytechnic University, Moscow, Russia
Prof. Spiridonov Ye.K., South Ural State University (National Research University), Chelyabinsk
Prof. Stefanenko I.V., Volgograd State Technical University, Volgograd, Russia
Dr. Trukhanov A.V., National Academy of Sciences of Belarus, Minsk, Republic of Belarus
Dr. Trukhanov S.V., National Academy of Sciences of Belarus, Minsk, Republic of Belarus
Dr. Turchenko V.A., Joint Institute for Nuclear Research, Dubna, Russia
Prof. Valtchev Stanimir, New University of Lisbon, Lisbon, Portugal
Prof. Vartanov M.V., Moscow Polytechnic University, Moscow, Russia
Prof. Vasilyev A.S., Bauman Moscow State Technical University (National Research University), Moscow, Russia
Dr. Vinh Nguyen Quang, Vietnamese Academy of Science and Technology, Hanoi, Vietnam
Prof. Vinnik D.A., South Ural State University (National Research University), Chelyabinsk, Russia
Prof. Yershov M.Yu., Moscow Polytechnic University, Moscow, Russia
Prof. Yousef Ibrahim, Federation University Australia, Churchill, Australia
Prof. Zjuzev A.M., Ural Federal University named after the first President of Russia B.N. Yeltsin, Ekaterinburg, Russia

Organizing Committee

Prof. Gasiyarov V.R., South Ural State University (National Research University), Chelyabinsk, Russia

Prof. Safonov Ye.V., Moscow Polytechnic University, Moscow, Russia

Prof. Sukhenko N.A., Platov South-Russian State Polytechnic University (Novocherkassk Polytechnic Institute), Novocherkassk, Russia

Prof. Makarov A.M., Volgograd State Technical University, Volgograd, Russia

Prof. Kulmukhametova A.S., South Ural State University (National Research University), Chelyabinsk, Russia

Prof. Maklakov A.S., South Ural State University (National Research University), Chelyabinsk, Russia