

# Preface

The 5th International Conference on Industrial Engineering was held on 25-29 of March 2019, Russian Federation. The conference organizers were in Sochi, as a main conference venue and South Ural State University (national research university), Chelyabinsk; Platov South-Russian State Polytechnic University, Novocherkassk, Rostov region; Moscow Polytechnic University and Volgograd State Technical University as the additional conference venues.

The conference was carried out under financial support of the South Ural State University (national research university).

The conference was really large-scaled and international. The international program committee has selected more than 500 reports. The conferees represented 63 Russian cities from the western and central parts to the Far East regions. International participants represented such countries as China, Germany, Kazakhstan, Kyrgyzstan, Portugal, Saudi Arabia, Tajikistan, Ukraine, USA, Uzbekistan.

The conference participants submitted papers reflecting recent advances in the field of Industrial Engineering, in Russian and English. 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 international program committee has selected 200 papers for publishing in the Solid State Phenomena (Trans Tech Publications Ltd.).

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. Navrotskiy 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. Bespalov 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. Dementyev 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