Mechanisms and Machine Science

Volume 70

Series Editor

Marco Ceccarelli, Department of Industrial Engineering, University of Rome Tor Vergata, Roma, Italy

Editorial Board Members

Alfonso Hernandez, Mechanical Engineering, University of the Basque Country, Bilbao, Vizcaya, Spain
Tian Huang, Department of Mechatronical Engineering, Tianjin University, Tianjin, China
Yukio Takeda, Mechanical Engineering, Tokyo Institute of Technology, Tokyo, Japan
Burkhard Corves, Institute of Mechanism Theory, Machine Dynamics and Robotics, RWTH Aachen University, Aachen, Nordrhein-Westfalen, Germany
Sunil Agrawal, Department of Mechanical Engineering, Columbia University, New York, NY, USA

This book series establishes a well defined forum for monographs, edited Books, and proceedings on mechanical engineering with particular emphasis on MMS (Mechanism and Machine Science). The final goal is the publication of research that shows the development of mechanical engineering and particularly MMS in all technical aspects, even in very recent assessments. Published works share an approach by which technical details and formulation are discussed, and discuss modern formalisms with the aim to circulate research and technical achievements for use in professional, research, academic, and teaching activities. This technical approach is an essential characteristic of the series. By discussing technical details and formulations in terms of modern formalisms, the possibility is created not only to show technical developments but also to explain achievements for technical teaching and research activity today and for the future. The book series is intended to collect technical views on developments of the broad field of MMS in a unique frame that can be seen in its totality as an Encyclopaedia of MMS but with the additional purpose of archiving and teaching MMS achievements. Therefore the book series will be of use not only for researchers and teachers in Mechanical Engineering but also for professionals and students for their formation and future work. Indexed in SCOPUS, Ei Compendex, EBSCO Discovery Service, OCLC, ProQuest Summon, Google Scholar and SpringerLink.

More information about this series at http://www.springer.com/series/8779

Stanisław Zawiślak · Jacek Rysiński
Editors

Engineer of the XXI Century

Proceedings of the VIII International Conference of Students, PhD Students and Young Scientists

Springer

Editors
Stanisław Zawiślak
University of Bielsko-Biala
Bielsko-Biała, Poland

Jacek Rysiński
University of Bielsko-Biala
Bielsko-Biała, Poland

ISSN 2211-0984 ISSN 2211-0992 (electronic)
Mechanisms and Machine Science
ISBN 978-3-030-13320-7 ISBN 978-3-030-13321-4 (eBook)
https://doi.org/10.1007/978-3-030-13321-4

Library of Congress Control Number: 2019931518

© Springer Nature Switzerland AG 2020
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The present book contains chosen papers of high quality which were submitted for the VIII International Conference of Students and Young Scientists *Engineer of the XXI Century* held annually at the University of Bielsko-Biala, in Poland. The conference has been organized since 8 years at the Faculty of Mechanical Engineering and Computer Science of our university. Town Bielsko-Biała is located in the south part of Poland near Slovak and Czech Republic borders. The town is dynamic and beautiful; it has old tradition. It was established in 1312. Lying on the crossroads, it had a multinational character. Even at the present times, having communities of Christians, Protestants and Jews as well as small groups of Italians, Ukrainians and Mexicans, it is slightly different than other Polish towns. The general good state of the town (considering workforce, wealth and culture) is related to a variety of automotive industry factories as well as IT companies. Cultural events make town vivid and interesting as a place for spending a free time.

Despite the fact, that the conference has been organized—like it was mentioned—just since a few years, it has a well-established community of permanent participants from many countries. In general, it is dedicated to mechanical engineering and computer science; however, also papers related to mechanism theory, robotics, automation and bioengineering were submitted. The number of presented papers has been constantly increasing year by year. Besides, Poles, the participants originated from Ukraine, Italy, France, Kazakhstan, Spain, Turkey and Russia, have attended the event. Previously, the papers were published in the volume printed at the University of Bielsko-Biala. Due to the increasing number of participants and increasing scientific level of works, the organizers decided to propose this book for publishing the best, outstanding papers.

The conference is under constant patronage of IFToMM, as well as domestic-level patronages, e.g. of Polish Minister of Science and Higher Education and the Rector of the University of Bielsko-Biala. We would like to express our gratitude to all persons who wish us successes, especially to Prof. Marco Ceccarelli (Editor of MMS Book Series), for his cordial attitude, support and advice.

We do hope that the book would be interesting not only for all participants but also for readers related to the fields of knowledge covered by conference papers, and it will be simultaneously a valuable record of presentations given during the present edition of the conference on 7 December 2018.

This year, we have also many participants from different countries. In the present book, there are authors from Poland, Ukraine, Russia and Vietnam. The highest level works were chosen for this volume. The book is divided into three parts related, in general, to mechanical engineering, bioengineering and computer science and its application in engineering and medicine.

Every conference is a forum for meetings of scientists, for discussions, for exchanging ideas, for proposals of cooperation, for common international projects. We do hope that the meeting on 7 December 2018 will fulfill expectations of all participants, and it would be a great impulse for their further scientific achievements as well as for international cooperation.

Bielsko-Biała, Poland
December 2018

Stanisław Zawiślak
Jacek Rysiński

Contents

Part I Mechanical Engineering

1 DFA Methods' Comparison Analysis Using Single-Stage Gearbox as an Example 3
J. Matuszek and T. Seneta

2 Calculation of Drive Mechanism for Novel Rotary Hexapod with Single Motor 17
A. Fomin, D. Petelin and V. Glazunov

3 Roller Function-Generating Mechanism Preventing the Crank-Drive Machines' Overloads 29
V. Semenyuk, V. Lingur, N. Punchenko and P. Falat

4 Flatness-Based Control Design for Two-Mass System Using Induction Motor Drive Fed by Voltage Source Inverter with Ideal Control Performance of Stator Current 39
Vo Thanh Ha and Nguyen Phung Quang

5 Mesoscopic Modelling of Unidirectional Polymer Laminate Reinforced with Glass Roving Fabric 51
J. Marszałek and J. Stadnicki

6 The Pollutant Emission of the Aftermarket Vehicles 61
B. Puchałka, A. Szczotka and J. Nowakowski

7 Simulation of Adhesive Joint Strength in Peel Test Conditions 71
M. Śliwka

8 Effect of Heat Treatment on Tensile Properties and Hardness of a Forging Made of EN AW-6082 Alloy 81
J. Pezda and G. Karpierz

9 Modelling of Bending Pre-compressed Beams Made of Resin L285 93
K. Cieślar and Jacek Rysiński

10 Studying the Dynamic Properties of Thermoelectric Fire Detectors in Terms of False Tripping of an Air Fire Suppression System 103
A. Szelmanowski, M. Zieja, A. Pazur and K. Głyda

11 Studying the Dynamic Properties of an Amplifier Board Execution Block in Terms of False Tripping of an Aircraft Fire Suppression System 121
A. Szelmanowski, M. Zieja, A. Pazur and K. Głyda

12 Assessment of Light Pollution Based on the Analysis of Luminous Flux Distribution in Sports Facilities 139
M. Sielachowska and M. Zajkowski

Part II Bioengineering

13 Study of Improvement of Biosensor Matrix Stability 153
A. Kłos-Witkowska and V. Martsenyuk

Part III Computer Science

14 On Application of Kertesz Method for Exponential Estimation of Neural Network Model with Discrete Delays 165
O. Nakonechnyi, V. Martsenyuk and A. Sverstiuk

15 Methods of Compensation of Dynamic Objects Movement in Video Pototy in Video Confidential System 177
M. Dvorsky, O. Musienko, O. Stetsenko, D. Zhurbinskiy, U. Iatsykovska and D. Jancarczyk

16 Technological Concept of Differential Processing of Segments of Video Frame Taking into Account of Key Information 185
V. Barannik, D. Medvedev, Yu. Ryabukha, O. Kulitsa, M. Bernas and A. Aftyka

17 Method of Safety of Informational Resources Utilizing the Indirect Steganography 195
V. Barannik, D. Barannik, A. Bekirov, S. Korotin, O. Veselska and L. Wieclaw

18 Development of Adaptive Arithmetic Coding Method to the Sequence of Bits 203
V. Barannik, D. Havrylov, V. Barannik, A. Dodukh, T. Gancarczyk and K. Gowin

19 Complex Method of Video Stream Intensity Control 209
V. Barannik, V. Himenko, V. Tverdokhleb, S. Kovalevskiy, K. Warwas and M. Brocki

20 Finding the Fact of Transfer of the Embedded Information on the Basis of Statistical Methods of Pattern Recognition and Machine Learning 217
O. Shmatok and O. Veselska

21 Research of the Training Ground for the Protection of Critical Information Resources by iRisk Method 227
L. Galata and B. Korniyenko

22 Review of Maze Solving Algorithms for 2D Maze and Their Visualisation 239
R. Niemczyk and Stanisław Zawiślak

23 On Data Mining Technique for Differential Diagnostics Based on Data of Arterial Oscillography 253
O. Mintser, V. Martsenyuk and D. Vakulenko