

23rd International Multidisciplinary Scientific GeoConference (SGEM 2023)

Informatics, Geoinformatics and Remote
Sensing

SGEM International Multidisciplinary Scientific GeoConference
Volume 23, Issue 2.1

Albena, Bulgaria
3 - 8 July 2023

Editors:

**Oleksandr Trofymchuk
Baiba Rivza**

ISBN: 978-1-7138-7674-8

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2023) by SGEM WORLD SCIENCE (SWS) Scholarly Society
All rights reserved.

Printed with permission by Curran Associates, Inc. (2023)

For permission requests, please contact SGEM WORLD SCIENCE (SWS) Scholarly Society
at the address below.

SGEM WORLD SCIENCE (SWS) Scholarly Society
10/11 Gerlgasse
Vienna 1030, Austria

Phone: +359 2 405 18 41

Fax: +359 2 405 18 65

sgem@sgem.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com



23rd INTERNATIONAL MULTIDISCIPLINARY SCIENTIFIC GEOCONFERENCE - SGEM 2023

03 – 09 July 2023 - Albena, Bulgaria

**CONFERENCE PROCEEDINGS OF SELECTED PAPERS in
INFORMATICS, GEOINFORMATICS AND REMOTE SENSING
ISSUE 2.1**

Editors-in-Chief:

- **Prof. DSc. Oleksandr Trofymchuk, National Academy of Sciences of Ukraine,
UKRAINE**
- **Prof. Dr. hab. oec. Baiba Rivza, Latvian Academy of Sciences, LATVIA**

DISCLAIMER

The International Multidisciplinary Scientific GeoConference SGEM (Survey, Geology, Ecology and Management) are focused on GLOBAL WARMING, CLIMATE CHANGE, CO₂ REDUCTION, BIODIVERSITY, AND GREEN TECHNOLOGIES FOR A SUSTAINABLE FUTURE.

Authors are responsible for the content and accuracy of the written papers. Opinions expressed are not meant to represent or reflect the position of the SGEM International Scientific Committee members.

No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of the SGEM International Scientific Committee on Earth and Planetary Sciences.

Copyright © SGEM WORLD SCIENCE (SWS) Scholarly Society 2023
10/11 Gerlgasse, Vienna 1030, Austria
Published by STEF92 Technology
Total print: 5000

E-mail: sgem@sgem.org | URL: www.sgem.org

ISSN 1314-2704

DOI: 10.5593/sgem2023/2.1

FOREWORD

The International Multidisciplinary Scientific GeoConference SGEM is focused on AGENDA 2030 Goals - GLOBAL WARMING, CLIMATE CHANGE, CO2 REDUCTION, BIODIVERSITY, AND GREEN TECHNOLOGIES FOR A SUSTAINABLE FUTURE.

In an ever-evolving world, amidst the vast expanse of the universe, Earth remains our singular home — a beacon of life, mystery, and endless curiosity. It is with immense pride and anticipation that we present the 2023 Conference Proceedings in Earth and Planetary Science, a collective endeavor of minds passionate about our world and the celestial wonders beyond.

The beauty of science, particularly in the realm of geosciences, lies in its ability to unite us. It transcends borders, politics, and cultural divides, binding us together in pursuit of knowledge, understanding, and enlightenment. This year, our focus aligns with the noble aspirations of Agenda 2030, reminding us that our planet's health and sustainability are integral to our shared future. Every paper within these pages stands as a testament to our collective commitment to that goal.

Moreover, this conference encapsulates the harmonious dance between the Earth as a place we live in and to care for, and the Planet, with its place in the Universe - different but intertwined, sharing the primary goal of interpreting, understanding and celebrating the Universe and our place in it. Like an artist who captures the majesty of a mountain range or the vastness of space, our researchers, too, paint with data, hypotheses, and discoveries, sketching a future where knowledge drives progress.

In a world where discord often grabs headlines, this gathering underscores that there exist realms untouched by strife, where camaraderie and cooperation reign supreme. This is the world of geosciences: a haven for curious minds, a frontier for explorers, a canvas for dreamers.

As you delve into these meticulously peer-reviewed articles, let them not only inform you but inspire you. Let them remind you of the magic that happens when diverse minds converge for a singular purpose. **And let them serve as a beacon of hope, signaling a future where science, with its inherent artistry, continues to light our way.**

**In anticipation of the better future and optimism,
Sincerely yours,**

Prof. DSc. Oleksandr Trofymchuk
Editor-in-Chief of XXIII SGEM GeoConference Proceedings
National Academy of Sciences of Ukraine, UKRAINE

Prof. Dr. hab. oec. Baiba Rivza
Editor-in-Chief of XXIII SGEM GeoConference Proceedings
Member of the Presidium of the Latvian Academy of Sciences, LATVIA
President of the Latvian Academy of Agricultural and Forestry Sciences
Vice-chair of the Latvian Council of Higher education
President of Latvian universities professors' association
Expert from the European Academy of Sciences Academic Advisory Board (EASAC)

CONFERENCE PROCEEDINGS CONTENTS

INFORMATICS

- 1. APPLICATIONS OF SOFTWARE TOOLS FOR HYDROGEN SAFETY STUDIES**, Dr. Vlad Mihai Pasculescu, Dr. Marius Cornel Suvar, Dr. Marius Simion Morar, Eng. Laurentiu Munteanu, Eng. Andrada Denisa Matei3
- 2. APPROACH TO THE VISUALIZATION OF TIMELINES OF IMAGES GENERATED BY FORECASTING MODELS**, Vedanta Somnathe, Dr. Todor Branzov..... 11
- 3. BLACK BOX MODEL AS A POSSIBILITY TO MODEL OUT THE COMBUSTION PROCESS IN AN ENGINE**, Piotr Kardasz 19
- 4. COMPARING EMBEDDED SOLUTIONS FOR MECHANICAL VIBRATION ANALYSIS OF A 3D-PRINTED CYCLOIDAL GEARBOX**, Dawid Socholik, Aleksander Skrzypiec, Dr. Eng. Tymoteusz Turlej.....27
- 5. COMPARISON OF THE PERFORMANCE OF DIFFERENT NEURAL NETWORK ARCHITECTURES AND PRE-TRAINED NEURAL NETWORKS FOR THE CLASSIFICATION OF FOREST FLORA AND FAUNA**, Witold Prusak, Aleksander Skrzypiec, Dr. Tymoteusz Turlej35
- 6. COMPUTING PLATFORM FOR INTEGRATING WIRELESS HETEROGENEOUS NETWORKS INTO INDUSTRIAL INTERNET OF THINGS SYSTEMS**, Postgrad. Stud. Maxim Kolchurin, Prof. Dr. Alexey Platunov, Assoc. Prof. Ph.D. Vasilij Pinkevich.....41
- 7. CONTROL SYSTEM REDUCING ENERGY CONSUMPTION OF MANIPULATOR DRIVES BASED ON REINFORCEMENT LEARNING**, M.Sc. Eng. Patryk Bałazy, M.Sc. Eng. Paweł Knap, Ph.D Eng. Tymoteusz Turlej, Artur Stefańczyk49
- 8. CYBERTERRORISM AND SOCIAL ENGINEERING - METHODS AND COUNTERMEASURES**, Barbora Kotkova, Marta Blahova57
- 9. DESIGNING CUSTOM COMPUTING PLATFORMS FOR CYBER-PHYSICAL SYSTEMS**, Assoc. Prof. Ph.D. Vasilij Pinkevich, Assoc. Prof. Ph.D. Arkady Kluchev, Engineer M.Sc. Vladislav Kluchev, Prof. Dr. Alexey Platunov.....65
- 10. EVALUATION OF THE QUALITY OF MATERIALS FOR PRODUCTION BY 3D PRINTING USING IMAGE ANALYSIS**, Eng. Kamil Gajewski, Dr. Eng. Tymoteusz Turlej, Julia Zięba, Bartosz Wermiński 73

11. IMPLEMENTATION OF MULTIMODAL INTERFACE FOR HUMAN–COMPUTER INTERACTION SYSTEM TO CONTROL A ROBOTIC WHEELCHAIR , Assoc. Prof. PhD. Elena Petrunina, Assoc. Prof. PhD. Elmin Bayramov, Denis Pecherskij.....	81
12. INFORMATION TECHNOLOGY FOR REAL-TIME MONITORING AND VISUALIZATION OF LOAD IN URBAN PUBLIC OPEN SPACES BASED ON SPATIAL AND STATISTICAL DATA ANALYSES OF HUMAN BEHAVIOUR , Dr. Marita Cekule, Dr. Ingus Mitrofanovs, Msc. Kaspars Cabs	89
13. THE IDENTIFICATION OF PERSONS USING EYE BIOMETRICS IN A SOCIETY WITH HIGH SECURITY DEMANDS , Barbora Kotkova, Marta Blahova	97
14. THE NUMERICAL SIMULATION OF CASTING PROCESS OF CAST MADE FROM AUSTEMPERED DUCTILE IRON (ADI) , Assoc. Prof. Ing. Peter Futas, PhD., Prof. Ing. Alena Pribulova, PhD., Assoc. Prof. Ing. Jozef Petrik, PhD., Ing. Peter Blasko, PhD., Ing. Vladimir Sabik.....	105
15. USE DATABASE IN ICT TO DISCUS THE FUEL BASE , Piotr Kardasz.....	113

GEOINFORMATICS

16. ANALYSIS OF MACHINE LEARNING ALGORITHMS PERFORMANCES FOR ROAD SEGMENTATION ON VERY HIGH-RESOLUTION SATELLITE IMAGERY AS SUPPORT OF ROAD INFRASTRUCTURE ASSESSMENT , Ivan Brkić, mag. ing. geod. et geoinf., Assist. Prof. Dr. Mario Miler, Doc. Dr. Marko Ševrović, Prof. Dr. Damir Medak.....	121
17. ASCERTAINMENT OF URBANIZED WATERSHEDS PARAMETERS FOR EVALUATION OF BIOGENIC ELEMENTS OUTFLOW , Assoc. Prof. Dr. Victor Tretyakov, Postgraduate Stepan Klubov, Prof. DSc. Vasiliy Dmitriev, Ress.Asist. Anna Nikulina, Ress. Assist. Adilkhan Orazalin	129
18. BRIEF ON DEVELOPMENT OF ICE LOAD ESTIMATION FOR HYDROTECHNICAL ENGINEERING , Assoc. Prof. Ph.D. Dmitry Sharapov.....	137
19. BURNED AREA PREDICTION USING SMOKE PLUME DETECTION FROM HIGH SPATIAL RESOLUTION IMAGERY , Dr. Julia Āhlén.....	145
20. DETECTION OF SURFACE SOIL DISTURBANCE AREAS AS A RESULT OF MILITARY ACTIONS IN UKRAINE BY REMOTE SENSING METHODS , Prof. Oleksandr Trofymchuk, PhD Vyacheslav Vishnyakov, PhD Natalia Sheviakina, PhD Viktoriia Klymenko, PhD Snizhana Zahorodnia.....	153

21. DEVELOPMENT OF INDOOR POSITIONING SYSTEM, BASED ON LEAFLET MAP, GEOLOCATION AND WI-FI POSITION ESTIMATION WITH ACCURACY ASSESSMENT, Chief Assist. Prof. Ph.D. Tamara Ilieva 163

22. GEO-STATISTICAL ANALYSIS OF DISTRIBUTION OF As, Fe, Mn, Cu, AND Zn IN ARTANA MINE TAILING FROM FLOATING PROCESS, MSc. Berat Sinani, Prof. Dr. Blazo Boev, Prof. Dr. Arianit Reka, Prof. Dr. Ivan Boev, Prof. Dr. Musaj Paçarizi, MSc. Epir Qeriqi 171

GEODESY AND MINE SURVEYING

23. ACCURACY ASSESSMENT OF THE PRINCIPAL STRAINS IN DEFORMATION ANALYSIS, Sen. Lecturer Anton Bannikov, Prof. DSc. Viktor Gordeev 181

24. APPROACH TO DIGITAL TWIN OF IMMOVABLE CULTURE HERITAGE, Ivan Marinov, Gabriela Simeonova, Assoc. Prof. Dr. Christina Mickrenska, Assoc. Prof. Dr. Gergana Antova 193

25. GNSS MONITORING OF THE GEODYNAMIC PROCESSES IN THE AREA OF SOFIA AN IMPORTANT TOOL FOR STUDYING OF RECENT GEODYNAMICS AND NATURAL RISK PREVENTION IN A HIGHLY POPULATED AREA, Assoc. Prof. Dr. Nikolay Dimitrov, Prof. Dr. Radoslav Nakov, Dr. Anton Ivanov, Dr. Petar Danchev 201

26. HARMONICAL ANALYSIS OF SEA LEVEL DATA AT VARNA TIDE GAUGE, Dr. Anton Ivanov 209

27. INDUSTRY MODEL FOR GEODETIC ACTIVITIES IN RELATION TO THE IMPLEMENTATION OF THE CULTURAL HERITAGE ACT IN THE REPUBLIC OF BULGARIA, Assoc. Prof. Dr. Eng. Ivan Kunchev 215

28. INTEGRATION THE NEW VELOCITIES RESULTS FROM MONITORING OF GEODYNAMIC PROCESSES IN THE AREA OF SOFIA IN THE COMMON FIELD OF HORIZONTAL VELOCITIES, Assoc. Prof. Dr. Nikolay Dimitrov..... 223

29. METHODOLOGY FOR ACCOUNTING DISPLACEMENTS OF THE OUTPUT COORDINATES FROM THE STATIC STATE GPS NETWORK IN GEODETIC PRACTICE, Assoc. Prof. Dr. Yuri Tsanovski 229

30. MONITORING OF TECTONIC MOVEMENTS IN THE ADRIATIC REGION THROUGH NATIONAL PERMANENT SATELLITE NETWORKS, Phd. Ethem Bejko, Prof. Dr. Rrapo Ormeni, Msc. Bledar Sina, Msc. Eduart Blloshmi, Msc. Dionald Muçaj 237

31. RESEARCH OF THE STATE GRAVIMETRIC NETWORK FOR THE TERRITORY OF THE REPUBLIC OF BULGARIA , Prof. Dr. Eng. Elena Peneva, Chief Assistant Prof. Dr. Eng. Stoyan Patalov	245
32. THE IMPACT OF RIVER SEDIMENTATION ON THE VARIABILITY OF THE SEA FLOOR TOPOGRAPHY IS ONE OF THE FACTORS WITH A SIGNIFICANT IMPACT ON THE DYNAMICS OF THE COASTLINE , Dr. Ethem Bejko, Dr. Albana Hasimi, Assoc. Prof. Dr. Gezim Gjata, Prof. Dr. Rrapo Ormeni, Dr. Dhurata Ndreko	253
33. TOPO GEODESIC MEASUREMENTS REGARDING MONITORING OVER TIME OF MOVEMENTS OCCURRING ON THE CONSOLIDATION SYSTEM FOR A HOUSING BUILDING LOCATED ON FABRICH STREET, CLUJ-NAPOCA , Assoc. Prof. Dr. Mircea Vasile Bondrea, Prof. Dr. Ioel Veres, Assoc. Prof. Dr. Sanda Nas, PhD Dorin Mihai Isac, PhD Bianca Raluca Bondrea.....	261
34. UML USE CASE MODEL OF GEODETIC ACTIVITIES IN RELATION TO THE ACT ON THE BLACK SEA COAST SPATIAL DEVELOPMENT IN BULGARIA , Marina Georgieva	269

PHOTOGRAMMETRY AND REMOTE SENSING

35. ANALYSIS OF THE CONSEQUENCES OF MILITARY OPERATIONS: INTEGRATION OF SPECTRAL INDICES AND REMOTE SENSING TO ASSESS AFFECTED AREAS , Associate Professor, Ph. D. Roman S. Molikeych	277
36. APPLICATION OF SAR DATA TIME SERIES FOR MONITORING OF GEODINAMIC PROCESSES IN THE SOFIA REGION , Assoc. Prof. Dr. Mila Atanasova, Prof. Dr. Hristo Nikolov	283
37. GEO-ECOLOGICAL CONSEQUENCES OF THE CLOSURE OF COAL MINES OF DONBAS (BASED ON RADIO-LOCATION SATELLITE SURVEYING MATERIALS) , PhD. Alexander Apostolov, PhD. Lesya Yelistratova, PhD. Artur Hodorovsky, Tetiana Orlenko, Maksym Tymchyshyn.....	291
38. MONITORING AND ASSESSMENT OF STORM DAMAGE TO FORESTS USING THE PHOTOGRAMMETRIC METHOD , Natalja Liba, PhD , Kaupo Kokamägi, Rauno Künnapuu, Kärt Metsoja	299
39. USING SELF-PROPELLED SPRAYERS FOR THE TARGETED APPLICATION OF HERBICIDES , Dr. Jakub Elbl, Assoc. Prof. Dr. Vojtěch Lukas, Dip. Ing. Jiří Mezera, Dip. Ing. Igor Huňady, Dip. Ing. Antonín Kintl	307

CARTOGRAPHY AND GIS

40. APPLICATION OF ELLIPTIC INTEGRALS IN MATHEMATICAL CARTOGRAPHY CALCULATIONS, Dr. Paweł Pędzich, Dr. Łukasz Wodzyński317

41. DEVELOPMENT OF WATER TECHNICAL INFRASTRUCTURE IN NEWLY ESTABLISHED BUILT-UP AREAS OF SMALL MUNICIPALITIES (CASE STUDY SOUTH BOHEMIAN REGION), Vendula Moravcová, Jana Moravcová, Denisa Pěkná325

42. FORESTRY SPATIAL DATA IN BULGARIA - IMPLEMENTATION AS PART OF EUROPEAN INFORMATION INFRASTRUCTURE, Assoc. Prof. Dr. Maria Asenova, Assist. Prof. Milena Danailova333

43. "GURGISTAN VILAYET MAP" CARTOGRAPHIC-GEOGRAPHICAL ANALYSIS, Dali Nikolaishvili, Maia Tskhvaradze, David Sartania, Revaz Tolovardava, Robert Maglakelidze341