



BOOK OF ABSTRACTS
1ST-2ND DECEMBER 2022
POZNAN, POLAND



XXVIII LSCE 2022 LIGHTWEIGHT STRUCTURES IN CIVIL ENGINEERING CONTEMPORARY PROBLEMS

Edited by:

Katarzyna Rzeszut, Robert Studziński and Jacek Szafran



LIGHTWEIGHT STRUCTURES IN CIVIL ENGINEERING

CONTEMPORARY PROBLEMS

XXVIII LSCE 2022
Book of Abstracts

Editors
Katarzyna Rzeszut
Robert Studziński
Jacek Szafran

Poznan University of Technology
Faculty of Civil and Transport Engineering
1st-2nd December 2022, Poznań, Poland

Cover design: Aleksandra Szczepańska
Technical editing and typesetting: Authors

© Copyright by Poznan University of Technology, Poznan 2022

ISBN 978-83-7775-675-1

The publisher is not responsible for any editorial errors because the publication is based on ready-to-print materials provided by authors.

Publishing House of Poznan University of Technology
61-138 Poznań, ul. Piotrowo 5
tel. +48 (61) 665 3516
www.wydawnictwo.put.poznan.pl

Edition 64 copies

Printing and bookbinding:
PERFEKT DRUK
ul. Skórzewska 63, 60-185 Skórzewo
tel. +48 (61) 666 05 19



**LIGHTWEIGHT STRUCTURES in CIVIL ENGINEERING
CONTEMPORARY PROBLEMS**

Monograph from Scientific Seminar

Organized by Polish Chapters of

International Association for Shell and Spatial Structures

Poznan University of Technology

Faculty of Civil and Transport Engineering

XXVIII LSCE

Poznań, 1st – 2nd of December 2022



LSCE 2022 – Scientific Committee

Katarzyna Rzeszut – Chairman, *Poznan University of Technology, Poland*

Chiara Bedon – *University of Trieste, Italy*

Bartłomiej Błachowski – *Institute of Fundamental Technological Research Polish Academy of Sciences, Poland*

Ewa Błazik-Borowa – *Lublin University of Technology, Poland*

Laszlo Dunai – *Budapest University of Technology and Economics, Hungary*

Aguinaldo Fraddosio – *Politecnico di Bari, Italy*

Marcin Gajewski – *Warsaw University of Technology, Poland*

Leroy Gardner – *Imperial College London, England*

Marian Giżejowski – *Warsaw University of Technology, Poland*

Jarosław Górski – *Gdańsk University of Technology, Poland*

Michał Guminiak – *Poznań University of Technology, Poland*

Eugeniusz Hotała – *Wrocław University of Science and Technology, Poland*

Piotr Iwicki – *Gdańsk University of Technology, Poland*

Robert Jankowski – *Gdańsk University of Technology, Poland*

Karoly Jarmai – *University of Miskolc, Hungary*

Stanisław Jemioło – *Warsaw University of Technology, Poland*

Marcin Kamiński – *Łódź University of Technology, Poland*

Aleksander Kozłowski – *Rzeszów University of Technology, Poland*

Tomasz Kubiak – *Lodz University of Technology, Poland*

Mieczysław Kuczma – *Poznań University of Technology, Poland*

Jörg Lange – *Technical University of Darmstadt, Germany*

Tomasz Lewiński – *Warsaw University of Technology, Poland*

Przemysław Litewka – *Poznań University of Technology, Poland*

Amelia Loja – *Engineering Institute of Lisbon, Portugal*

Leszek Małyżsko – *University of Warmia and Mazury, Olsztyn, Poland*

Jakub Marcinowski – *University of Zielona Góra, Poland*

Mariusz Maślak – *Cracow University of Technology, Poland*

Hartmut Pasternak – *Brandenburg University of Technology, Cottbus – Senftenberg, Germany*

Zbigniew Pozorski – *Poznań University of Technology, Poland*

Tomasz Siwowski – *Rzeszów University of Technology, Poland*

Leopold Sokół – *Centre des Hautes Etudes de la Construction, France*

Robert Studziński – *Poznań University of Technology, Poland*

Wojciech Sumelka – *Poznań University of Technology, Poland*

Jacek Szafran – *Lodz University of Technology, Poland*

Jacek Szer – *Lodz – University of Technology, Poland*

Maciej Szumigała – *Poznań University of Technology, Poland*

Andrzej Szychowski – *Kielce University of Technology, Poland*

Lucjan Ślęczka – *Rzeszów – University of Technology, Poland*

Romuald Tarczewski – *Wrocław University of Science and Technology, Poland*

Elżbieta Urbańska-Galewska – *Wrocław University of Science and Technology, Poland*

Ryszard Walentyński – *Silesian Technical University, Poland*

Paulo M. M. Vila Real – *University of Aveiro, Portugal*



**LIGHTWEIGHT STRUCTURES in CIVIL ENGINEERING
CONTEMPORARY PROBLEMS**

Monograph from Scientific Seminar
Organized by Polish Chapters of
International Association for Shell and Spatial Structures
Poznan University of Technology
Faculty of Civil and Transport Engineering



XXVIII LSCE
Poznań, 1st – 2nd of December 2022

LSCE 2022 – Organizing Committee

Organizing Committee of XXVIII LSCE 2022

Poznan University of Technology, Faculty of Civil and Transport Engineering

Katarzyna Rzeszut – Chairman

Jacek Szafran – Vice - Chairman

Robert Studziński – Vice - Chairman

Tomasz Szumigala – Secretary

Katarzyna Ciesielczyk

Maciej Dybizbański

Artur Matusiak

Aleksandra Szczepańska

Plenary Lectures

Bettina Brune – *Dortmund Technical University, Germany*

Marian Giżejowski – *Warsaw University of Technology, Poland*

Paulina Obara – *Kielce University of Technology, Poland*

Hartmut Pasternak – *Branderburg University of Technology at Cottbus, Germany*

Organizers



Politechnika Łódźka

Sponsors



Wielkopolska Okręgowa Izba Inżynierów Budownictwa
ul. Dworkowa 14; 60-602 Poznań
tel. 61 854 20 10; e-mail: biuro@woib.org.pl
www.woib.org.pl



Wielkopolska Okręgowa Izba Inżynierów Budownictwa
ul. Dworkowa 14, 60-602 Poznań
tel. 61 854 20 10; e-mail: biuro@woib.org.pl
www.woib.org.pl



Patronage



Foreword

The involvement of Poznan University of Technology in the organization of the XXVIII Conference on Lightweight Structures in Civil Engineering is perceived by me as a distinction but also as a proof of trust for the University. This activity fits perfectly into the University's mission to educate at all levels of higher education and in lifelong learning programs in close connection with scientific and research development. In all our activities, we strive for scientific excellence and education of the highest level, based on the knowledge of, and cooperation with the socio-economic environment. The implementation of our design, construction and development achievements within the economy is not without significance. Another priority is to provide employees, doctoral students and students with the best possible working conditions and professional development, as well as broadening their knowledge and acquiring their selected competences. Nowadays, Poznan University of Technology offers education at 9 faculties, running a total of 37 fields of study. Nearly 16,000 students, ca. 500 PhDs, study here and over 1,300 academic teachers care for their education. The didactic offer of Poznan University of Technology covers the most important fields related to modern technology with a recently launched program in Artificial Intelligence, it is also well adapted to the requirements of both domestic and foreign employers. High-quality scientific research is an integral element of the strategy of Poznan University of Technology, characterized with scientific achievements of its employees who have published more than 2,000 scientific positions: highly ranked articles, monographs, textbooks and other publications. The total number of PUT Library's collections is over 450,000 volumes. Among numerous achievements, the University is proud of the H2020 Marie Skłodowska-Curie Global Fellowships and ERC as well as numerous Horizon 2020 grants. Furthermore, our scientists are among the authorities of the Polish Academy of Sciences (7 representatives) and are also members of numerous international scientific societies. According to the Shanghai Ranking 2020 in disciplines, PUT was classified among the best 400 universities in the world in Mechanical Engineering. Among the top 2% of the best cited scientists, 36 are from our University (prepared by Stanford University in cooperation with the Elsevier).

Owing to EU funding, recent years have brought the development of research infrastructure on the Warta university campus. In 2020 our University also became a leader of European University EUNICE – a project funded by the European Commission. Our university consortium partners originate from Belgium, Germany, Greece, France, Finland, Italy, Portugal, Spain, and Sweden. The main goal of EUNICE is to build a common European University of the future and prepare its structure and management design within 3 years.

Therefore, I am convinced that Poznan University of Technology is an excellent environment for the organization of the XXVIII Conference on Lightweight Structures in Civil Engineering. It should be emphasized that this conference is a broad forum for discussion and exchange of experiences on the latest achievements in the broadly understood field of metal structures. The main topics refer to issues closely related to interest of many research groups especially in civil and mechanical engineering such as: advanced analysis and direct design methods, safety and reliability assessment, structural stability and integrity, plated, cable, membrane, shell and composite structures, robustness and resistance to progressive collapse as well as structural health monitoring, refurbishment and repair.

Finally, I would like to express my gratitude for assigning me, the Rector of Poznan University of Technology, as the honorary patron of the Conference, and I accept it as a token of appreciation for the University, but above all as a commitment. I am sure that the meeting will be held in a friendly atmosphere, rich in fruitful discussion and in the most possibly comfortable conditions.

Teofil Jesionowski
Rector of Poznan University of Technology

TABLE OF CONTENTS

PLENARY LECTURES

1. *An analytical GM model of the flexural-torsional buckling resistance of imperfect steel beam-columns* 9
M.A. Giżejowski
2. *Behaviour of tensegrity structures under the influence of periodic load* 13
P. Obara
3. *Structural relevance of residual welding stresses* 17
H. Pasternak
4. *New research for advanced, future-oriented design of cold-formed structures* 21
D. Ungermann, B. Brune, T. Lemański

LECTURES

5. *Determination of thermal properties of mineral wool required for the safety analysis of sandwich panels subjected to fire loads* 25
E. Ablaoui, M. Malendowski, W. Szymkuć, Z. Pozorski
6. *Application of BIM to improve the sustainability and prevention failures existing object. Case study on steel chimneys* 29
M. Ancelin, E. De Morais Dias, A. Grasselli, D. Jasińska, N. Morise, G. Laot, M. Dutkiewicz
7. *Experimental tests of eaves bolted joints of cold-formed steel portal frames under monotonic and cyclic loading* 33
R. Budziński, L. Ślęczka
8. *Effect of two different methods of creating. A topology on geodesic domes under seismic excitation* 37
D. Bysiec, A. Janda, T. Maleska
9. *Interaction between sandwich panel and thin-walled beam for various connection methods - experimental investigation* 41
K. Ciesielczyk, R. Studziński
10. *Structural optimization for sustainable structures in seismic areas* 43
E. Crespino, G. Fallacara, A. Fraddosio, M. D. Piccioni
11. *Stability analysis of straight elastic bars of atypical cross-sections* 47
R. Czubacki, T. Lewiński
12. *Axial and lateral buckling of straight elastic bars of atypical cross-sections* 49
R. Czubacki, T. Lewiński
13. *Problems of shell industrial steel chimney due to operation state* 53
M. Dutkiewicz, D. Jasińska
14. *Adhesive connection of CFRP fabric to steel plate subjected to the shear stresses* 57
M.A. Dybizbański, K. Rzeszut
15. *Influence of load application of TWCS sigma type beams* 59
M.A. Dybizbański, K. Rzeszut, A. Szczepańska
16. *Modelling visco-hyperelastic shells in Abaqus* 61
A. Franus, S. Jemioło
17. *Application of the discrete wavelet transform to damage detection in a guy cable of guyed antenna mast* 63
A. Knitter-Piątkowska, M. Przychodzki, M.J. Guminiak
18. *Influence of the shortening of the upper flanges in trusses on internal forces in the construction elements of large-area warehouses* 67
K. Koziel, L. Rogoziński, M. Matyl, M. Wiśniowski, B. Minor
19. *Limit states of underground storage pressure tanks vs. structure reliability indexes* 71
T. Mikulski, R. Gierasimczyk, P. Sorn, J. Górski

20. *Research on the dynamics of lightweight shell and spatial structures with the aid of shake table and CFD tools* 73
A. Padewska-Jurczak, R. Walentyński, P. Szczepaniak, M. Wiśniowski, D. Cornik
21. *Loss of stability of short thin-walled columns with modified cross-sectional shape* 75
A.M. Pawlak, P. Paczos
22. *Parametric studies of eccentrically loaded sandwich panels regarding geometric ratios* 79
E.M. Pradhan, J. Lange
23. *A two-parameter model for initial design optimization of tensegrity T3 column* 83
A. Rutkiewicz
24. *Experimental studies of the profiled steel decks collaborative work* 85
V. Semko, P. Semko
25. *On the relative entropy as a safety assessment* 89
M. Strąkowski, M. Kamiński
26. *Bending stiffness of steel lattice telecommunication towers – optimization aspects* 93
J. Szafran, E. Kubacka, K. Juszczyk-Andraszyk
27. *Does standard test of trapezoidal sheets allow for a reliable assessment of their load-bearing capacity in real structures?* 97
T. Szumigala, K. Rzeszut
28. *Resistance of steel thin-walled C-sections under axial compression* 101
A. Szychowski, M. Siedlecka, P. Zabojszcza