Abstract book for the
21st MIKLÓS IVÁNYI
INTERNATIONAL
PHD & DLA SYMPOSIUM

Abstract book for the 21st MIKLÓS IVÁNYI INTERNATIONAL PHD & DLA SYMPOSIUM

ARCHITECTURAL, ENGINEERING AND INFORMATION SCIENCES

Edited by
Prof. Dr. Péter IVÁNYI

Pollack Press
Faculty of Engineering and Information Technology
University of Pécs

published in 2025 by
Pollack Press
Faculty of Engineering and Information Technology
University of Pécs
Pécs, Boszorkány u 2, H-7624, Hungary

Pollack Press is an imprint of University of Pécs

ISBN 978-963-626-505-2

Contents

Salute

The 21st Miklós Iványi International PhD & DLA Symposium is one of the most important scientific events at the Faculty of Engineering and Information Technology, University of Pécs. The Faculty hosts the meeting for young researchers and their professors. After the loss of the founder of this Symposium, Prof. Miklós Iványi, it has been decided to honour his memories and therefore this event will be named as "Miklós Iványi International PhD & DLA Symposium".

This is the 21st year that the PhD & DLA Symposium gives an opportunity to present the achievements of young researchers, to exchange information about the researches of the international partner institutions and to exchange valuable professional experiences and cultivate real friendships.

At the end let me greet the participants of the 21st Miklós Iványi International PhD & DLA Symposium and express my thanks to the organizers for their activity and to the participants of the former and this year's PhD & DLA Symposium to present papers. At the same time I wish you the best to continue with successful work.

Prof. Dr. Habil Gabriella MEDVEGY, DLA
Dean
Faculty of Engineering and Information Technology
University of Pécs

Foreword

The 21st Miklós Iványi International PhD & DLA Symposium is organized because it is thought that PhD & DLA students need a special forum in addition to their PhD & DLA program to present the results of their ongoing research. Furthermore the results should be discussed collecting proposals how to continue the work. The First, Second, Third, Fourth, Fifth, Sixth, Seventh, Eighth, Nineth, Tenth, Eleventh, Twelfth, Thirteenth, Fourteenth, Fifteenth, Sixteenth, Seventeenth, Eighteenth, Nineteenth and Twentieth International PhD & DLA Symposia were organized in 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023 amd 2024 and it is important to continue this tradition. Objectives of the PhD & DLA Symposium:

- to provide a forum for PhD & DLA students in engineering to present the progress of their work;
- to discuss the results of the ongoing PhD & DLA studies in order to support the future activity;
- to give the opportunity for PhD & DLA students to establish contact for international communication;
- to compare PhD & DLA studies in various countries.

The system of this symposium is to have oral presentations by the PhD & DLA students themselves, which are immediately followed by discussions that are scheduled in the program. Main results of the studies are summarized in the Pollack Periodica (an International Journal for Engineering and Information Sciences) published by Akadémiai Kiadó.

On behalf of the Organizing Committee, I would like to express thanks to the University of Pécs, Faculty of Engineering and Information Technology for hosting the Symposium.

Prof. Dr. Habil Péter IVÁNYI, PhD

International Scientific Committee

BACHMANN, Bálint	Hungary	KOREN, Csaba	Hungary
BALOGH, Jenő	USA	KOZAK, Drazan	Croatia
BORSOS, Ágnes	Hungary	KRÉSZ, Miklós	Hungary
BRUGGI, Matteo	Italy	KRUIS, Jaroslav	Czech Republic
DEVETAKOVIC, Mirjana	Serbia	KUCZMANN, Miklós	Hungary
FOLIC, Nadja	Serbia	LOGÓ, János	Hungary
FOLIC, Radomir	Serbia	MAGOULES, Frederic	France
FÜLÖP, Attila	Hungary	MEDVEGY, Gabriella	Hungary
GYERGYÁK, János	Hungary	MOVAHEDI, Rad Majid	Hungary
HALADA, Miklós	Hungary	ORBÁN, Zoltán	Hungary
JÁRMAI, Károly	Hungary	SOLTÉSZ, Andrej	Slovakia
JUTILA, Aarne	Finland	SZŰCS, István	Hungary
KARCHES, Tamás	Hungary	TOPPING, Barry	United Kingdom
KATONA, Tamás	Hungary	VÁRADY, Géza	Hungary
KÓCZY, László	Hungary	ZOLTÁN, Erzsébet	Hungary

Conference program

Day 1: Monday 27 Oct 2025

08:00-15:00 Registration desk open

09:00-10:00 Conference opening and invited lectures

10:00-10:30 Coffee / Tea Break

10:30-12:00 Conference session

12:00-13:00 Lunch (Room A008, ground floor) - *admission by ticket*

13:00-15:00 Conference session

15:00-15:30 Coffee / Tea Break

15:30-17:30 Conference session

18:30-23:00 Conference dinner,
Villány, wine tasting
(Buse leaves from the university, Boszorkány str. 2 at 18:30) - *admission by ticket*

Conference program

Day 1, Monday	
Time	Room A007
09:00-10:05	Conference opening, Plenary lectures page 5

Day 1, Monday				
Time	Room A007	Room A019	Room A017	Room A015
10:30-12:00	Civil engineering 1 page 6	Civil engineering 2 page 7	Mechanical Engineering page 8	-
12:00-13:00	Lunch - *admission by ticket*			
13:00-15:00	Architecture 1 page 9	Architecture 2 page 10	Architecture 3 page 11	Information Technology page 12
15:00-15:30	Coffee Break			
15:30-17:30	Architecture 4 page 13	Architecture 5 page 14	Architecture 6 page 15	-

Day 1: Monday, 27 Oct 2025: AM, Room A007

09:00-10:05

Conference opening

Professor Péter Iványi
University of Pécs

Professor Gabriella Medvegy
Dean of the Faculty of Engineering and Information Technology
University of Pécs

Plenary lecture

Introduction to the Discrete Bacterial Memetic Algorithm
Prof. Kóczy T. László

Writing Technical Papers: Ethical and Related Issues
Prof. Barry H.V. Topping

10:00-10:05

Group photo in front of the building

10:30-12:00

Civil engineering 1

Chaired by Prof. Radomir Folic and Prof. János Lógó

P-43 Automated Optimization of Steel Trusses with Elasto-Plastic Behaviour Using a Neural Network-Genetic Algorithm Method
P. Grubits, M. Movahedi Rad

P-44 Symmetry Measure of Truss Structures Based on Group Representation Theory
M. Módis, F. Kovács

P-45 Reliability Assessment of SHM Strain Measurements in the Southern Danube Railway Bridge
A. I. Mansi, L. Dunai

P-46 Numerical Simulation of Shear Bond at Concrete Interfaces Using Element Deletion
V. Shafaie, M. Movahedi Rad

P-47 The Influence of Testing Method on the Determination of the Angle of Shear Strength in Sands: A Comparison of In-Situ and Laboratory Data
C. Szabóová, E. Kučová

P-48 Structural Design and Analysis of a Reinforced Concrete Bridge over the Mohansa River, Tanzania
S. B. Julius, S. Elhadad, A. Salem, A. Fülöp, Z. Orbán

12:00-13:00: Lunch

10:30-12:00

Civil engineering 2

Chaired by Prof. Andrej Soltész and Prof. Csaba Koren

P-49 Hydraulic Modeling and Water Level Dynamics: A Case Study of SĺňavaReservoir, Slovakia
D. Pavlov, L. Čubanová

P-50 Flood Protection of the Municipality in the Little Carpathians
N. Bilčíková, M. Červeňanská

P-51 Experimental Investigations of Downstream Water Level Effect on the Discharge Capacity of the Central Weir at the Čunovo Water Structure
R. Tóth, J. Rumann, A. Rutzká

P-52 Tracking the Lifespan of Vortical Structures in Forced Isotropic Turbulent Flow
H. Ahmed, W. Abdel Kareem, Y. Velísková

P-53 Shared Roads, Different Codes: How Do Cyclists Perceive Autonomous Vehicles?
A. Hammami, A. Borsos

12:00-13:00: Lunch

10:30-12:00

Mechanical Engineering

Chaired by Prof. Jaroslav Kruis

P-65 Optimal Supply Temperature for Fan-Coil Heating Systems Considering Thermal Comfort
Z. Tamásik, G. Loch, L. Budulski, A. Ózdi, B. Cakó

P-66 Dynamic Comfort Mapping and PMV Estimation with Neural Networks and On-Site Measurements
A. Ózdi, B. Cakó, L. Budulski, G. Loch, Z. Tamásik

P-67 Investigation of the Compensating Effect of Terminal Heating Units near Cold Glazed Surfaces
G. Loch, L. Budulski, A. Ózdi, Z. Tamásik, Á. Borsos, B. Cakó

P-68 Application of Questionnaire-Based Methods to Support a Fuzzy Decision Tree Model of Comfort Perception
L. Budulski, A. Ózdi, G. Loch, Z. Tamásik, B. Cakó, J. Gyergyák

12:00-13:00: Lunch

Day 1: Monday, 27 Oct 2025: PM, Room A007

13:00-15:00

Architecture 1

Chaired by Prof. Mirjana Devetakovic

P-1 Curating the Immersive Field: The Integration of Fashion, Craft and Culture in Space
T. Chen, G. Medvegy, X. Jin

P-2 A Study on Architectural Design Practice Based on the Concept of Futurism
H. Cao, K. Guo

P-3 The Meaning of Home at a Civilizational Scale: A Framework for Architectural Design in Multicultural Societies
N. Golshani

P-4 The Role of Multimedia Spaces in Museum Narration from the Perspective of Cross-Cultural Communication
Z. Renkun, A. Tamás

P-5 The Stair
N. Ramos Gonzalez, T. Z. Dányi

P-6 A Comparative Study of Art Deco Architecture in Budapest and Shanghai
H. Li, B. Baranyai, M. Halada

P-7 Architectural Regeneration on a Construction Waste Landfill
X. Jin, K. Jiao

15:00-15:30: Coffee break

13:00-15:00

Architecture 2

Chaired by Dr. Erzsébet Zoltán

P-8 Balancing Abundance and Need: Daylight, Human-Centric Lighting and Sustainable Housing in the Middle East
L. Esau, E. S. Zoltán

P-9 Lighting Design from the Perspective of ”Great Health”
S. Xiao, A. Tamás

P-10 Not a House but a Home - Architecture and Information Technology in the Service of Social Responsibility
T. Z. Dányi, K. F. Nightngale

P-11 Integrating SLR and Expert Evaluation through FAHP for Assessing Holistic School Building Design Strategies across Climate Zones
K. Dedar Salam, T. J. Katona, B. Baranyai

P-12 Analyzing Adaptability in Office Typologies: Toward Sustainable and Flexible Design Strategies
D. M. A. Abu-Lail, E. S. Zoltán

P-13 Adaptive Design of Kindergarden Built Environments under the Eco-Friendly Concept
H. Cao

P-14 Study on the Assessment of the Built Environment of Community Centers and Optimization Strategies from the Perspective of Urban Health Examination
A. Greg, D. Zhao, Y. Qian, W. Gong, Y. Wu, H. H. Liang

P-15 Integrating Heritage Protection Research into Architectural Education: Adaptive Reuse and Revitalization in Practice-Based Learning
A. Greg

15:00-15:30: Coffee break

13:00-15:00

Architecture 3

Chaired by Prof. Ágnes Borsos

P-16 Interior Design Support of Function through the Presentation of Three Projects
S. Jurdik, Z. Bittner, G. Medvegy, Á. Borsos

P-17 Study on the Application of Spatial Scale in Interior Aging-Friendly Design
Q. Cui, P. Zilahi, X. Jin

P-18 Adaptability of Living Spaces to Changing Life Situations
D. Szurduk

P-19 Exploring Smart Community Development Strategies in the Context of Old Residential Area Renovation
Z. Li

P-20 Analysis of Apartments in the Retfala Nova Settlement: Case Study of Osijek
D. Koški, I. Brkanić Mihić, E. S. Zoltán, N. Ramos Gonzalez

P-21 Reimagining Historical Preservation: The Erbil Citadel Houses as a Model for Adaptive Heritage Reuse
W. A. S. Goriel, T. Molnár, E. S. Zoltán

P-22 The Symbolic System of Small-Town Hungarian Architecture - The Transformation of the Sándor Petőfi Cultural Center in Kiskőrös
Z. Bittner, S. Jurdik, G. Medvegy, Á. Borsos

P-23 Modular Renovation of Community Healthcare Centre Wards: Infection Control Zoning and Dual Circulation
Z. Fu, X. Jin, D. Rétfalvi

15:00-15:30: Coffee break

13:00-15:00

Information Technology

Chaired by Prof. Barry H. V. Topping and Prof. Péter Iványi

P-56 Measuring the Effectiveness of Simulated Data for Depth Map Generation
B. Sebők-Tornai, G. Várady, L. Czúni

P-57 Towards Robust and Generalizable Video Anomaly Detection Via Data Balancing
M. I. D. Almurumudhe, O. Hornyák

P-58 Mathematical Background of the Construction and Application of 3D Meshes for Wound Reconstruction
S. Molnár-Zékány

P-59 Semantic Analysis of Unsequenced Variable Accesses
Á. Hárnási

P-60 Detecting Tagged Union Incosistencies with the Clang Static Analyzer
G. Tóthvári, K. Umann, Z. Porkoláb

P-61 Distributed Static Analysis Using Bazel and CodeChecker
T. Fürész, K. Umann, Z. Porkoláb

P-62 A Revision of Literature on Static Analysis Applicability
K. Umann, Z. Porkoláb

P-63 Predictive Maintenance Report Generation Using Large Language Models
M. Kernács, O. Hornyák

P-64 Trustworthy Parallelization Recommendations through Multi-Layer Validation: Combining LLVM Static Analysis, AI Pattern Recognition and OpenMP Specification Compliance
T. Ngo Phu Hoang, P. Iványi

15:00-15:30: Coffee break

15:30-17:30

Architecture 4

Chaired by Dr. Miklós Halada

P-24 Exploring Variable Acoustic Strategies in Concert Halls: Geometric, Material and Structure
Y. Tang, M. Halada, P. Paári

P-25 Sound Energy Weighted Evaluation Method for Average Reverberation Determination
Y. Tang, M. Halada, P. Paári

P-26 Parametric Design and Environmental Simulations for Climate-Responsive Architectural Solutions
K. Varga

P-27 Analyzing Adaptive Thermal Comfort Indoors in Jordan: An Experimental Study
S. Abdel-Salam, B. Cakó

P-28 Literature Review Establishing the Basis for Determining the Environmental Impacts of Residential Buildings
R. R. Szűrösné Ördög, T. Horváth, A. Veöreös

P-29 A Review of Urban Small-Scale BIPV Public Building Projects (2021-2025)
S. Tong, A. Greg

P-30 Exploring the Adaptability of Housing through Sustainable Solar Decathlon Europe Housing Prototypes
D. Ojo, Á. Borsos, G. Medvegy

P-54 Integrating Artificial Intelligence for Building Performance Enhancement: Thermal Comfort as a Key Optimization Parameter
S. Elhadad

15:30-17:30

Architecture 5

Chaired by Dr. János Gyergyák

P-31 Adaptive Approaches to Sustainable Urban Housing: The Case of Pécs
H. Tomajian, J. Gyergyák

P-32 The Alleyway as a Catalyst: Reinterpreting Naples' Urban Culture for Contemporary Community Design
T. Shi

P-33 City-Scale Analysis of a Deteriorated Urban Area in the Context of Pécs' Urban Development Strategies
D. Hetesi, D. Kalkán, J. Gyergyák

P-34 Green Retrofitting Strategies for Industrial Heritage in Urban Regeneration: A Case Study of the Ship Model Factory in China
W. Cheng

P-35 Adaptive Reuse for Strengthening Rural Identity
G. Szecsei

P-36 Scaling Sponge City Strategies: Policy, Financial and Governance Pathways for Urban Water Resilience
L. Ben Khadra

P-37 Mapping Toolchains in Positive Energy District Cases
Á. Magyari, G. Medvegy, A. Reith

P-38 A Typological Analysis of Public Space Networks in Chinese and Hungarian Settlements for Fostering Local Identity
X. Li, T. Zhao

15:30-17:30

Architecture 6

Chaired by Dr. Attila Fülöp and Dr. Márk Zagorácz

P-39 A Strategic Approach to Laser Scanning: Accuracy, Time and Data Complexity Balance - A Case Study
D. E. Simon, M. B. Zagorácz, P. M. Máder, T. Jászberényi, N. Bakai, O. Rák

P-40 Mapping and Optimizing Current Hungarian Heritage Processes through the Application of BIM Methodologies
T. Jászberényi, M. B. Zagorácz, P. Máder, O. Rák, D. E. Simon, N. Bakai

P-41 Semi-Automated Scan-to-HBIM: Reconstructing Classified Point Clouds into Geometry
R. Salah, N. Géczy, K. Ajtayné Károlyfi

P-42 Protectorate Heritage Buildings Coupled with Digital Twin-based Monitoring
S. Sakoudom, A. Greg

P-55 Geometric Refinement of Crowdsourced Maps to Support Early Engineering Designs
B. Gadó

Architecture

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 1, 2024.

Paper 1

Curating the Immersive Field: The Integration of Fashion, Craft and Culture in Space

T. Chen, G. Medvegy, X. Jin

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: cultural experience, traditional craft aesthetics, retail space design, interdisciplinary design, Infinite Paris

This thesis explores a critical question: how can fashion retail spaces become meaningful places of cultural experience, rather than mere points of sale. It argues that the integration of traditional craft culture with fashion and interior design holds the key to creating such immersive environments.

In an era where consumers seek identity and connection, this research positions traditional craft not as a relic, but as a living source of aesthetic value and narrative. The study moves beyond theoretical discussion by centering on the real-world case of Infinite Paris, a Sino-French cultural brand founded in Paris. Through an examination of its retail operations, workshops, and cultural events, the project investigates how craft aesthetics can be translated into contemporary design language and how interior spaces can be choreographed to foster deep cultural engagement.

The primary outcome is a practical, culturally-grounded framework for retail design. This work aims to contribute both to the fashion industry's cultural evolution and to the broader discourse on the contemporary relevance of traditional crafts.

Figure 1.1: On-site pictures

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 2, 2024.

Paper 2

A Study on Architectural Design Practice Based on the Concept of Futurism

H. Cao[1,2], **K. Guo**[2]

[1]*Jinzhong University, China*
[2]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: futurism, architectural design, ecological adaptation, integration

This study adopts the creation of a ”Mountain Future Ecological Organism” as the core architectural concept, actively responding to the triple demands of the post-industrial era for ”visual futuristic identity”, ”ecosystem integration”, and ”low-energy comfort” in architecture. The research aims to produce architectural works that simultaneously embody futuristic aesthetics, ecological friendliness and energy efficiency. Based on actual site conditions, the study utilizes digital fabrication technologies to achieve seamless integration of futuristic forms, ecological symbiosis concepts and passive design strategies. Through proactive design experimentation, it demonstrates that futuristic architecture can transcend mere visual expression and more importantly, achieve synergistic development between ecological sustainability and low energy consumption. The research seeks to expand possibilities for integrated design in contemporary architecture across the multidimensional objectives of ”futurity, ecology, and energy efficiency”, while providing exemplary models for creating more forward-looking, habitable, and sustainable built environments for humanity.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 3, 2024.

Paper 3

The Meaning of Home at a Civilizational Scale: A Framework for Architectural Design in Multicultural Societies

N. Golshani

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: home, identity, culture, civilization, architectural design, sense of belonging, meaning, worldview, patterns of life

Home has always been more than a physical shelter; it is a place where identity, memory and a sense of belonging are formed. Thinkers such as Heidegger, Bachelard, and Norberg-Schulz describe the home as the point of connection between human beings and the world, a space in which meaning is experienced. Yet architectural research has often remained on individual or social levels, rarely engaging with the deeper cultural and civilizational layers. This study proposes that shared elements of civilizations - such as language, mythology, worldview and patterns of life - play a decisive role in shaping the meaning of home and thus provide a valuable framework for comparative analysis. The central question is whether understanding the meaning of home at a civilizational scale can inspire new approaches to contemporary design, especially in today's multicultural societies where people from diverse civilizational backgrounds live together. The anticipated outcome of this inquiry is to open new perspectives for architectural design - design that reflects not only physical needs but also cultural meanings and a renewed sense of belonging.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 4, 2024.

Paper 4

The Role of Multimedia Spaces in Museum Narration from the Perspective of Cross-Cultural Communication

Z. Renkun, A. Tamás

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: cross-cultural communication, museum narrative, multimedia space, national cultural soft power, international museum practice

In the context of globalization, cultural communication has become a core dimension for enhancing a country's cultural soft power. Museums, as carriers of cultural memory and narratives, are facing the dual challenges of "cross-cultural interpretation" and "audience acceptance". Traditional museum narratives rely on physical exhibits and text labels. When facing audiences from different cultural backgrounds, there are often obstacles such as alienation of cultural symbols, lack of contextual information and single communication channels. These obstacles not only reduce the effectiveness of cultural transmission but also restrict the function of museums as "platforms for cross-cultural dialogue". Against this background, this study focuses on the core issue of "the role of multimedia spaces in museum narratives from the perspective of cross-cultural communication", aiming to explore how multimedia technologies (including immersive projection, AR/VR interaction, multilingual digital narratives, etc.) can reconstruct museum narrative spaces, break cultural boundaries and enable cultural narratives to be understood and accepted by audiences from diverse cultures.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 5, 2024.

Paper 5

The Stair

N. Ramos Gonzalez, T. Z. Dányi

Institute of Architecture, Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: staircases, architectural elements, architecture, theory of architecture

This project undertakes a theoretical exploration of one of the most fundamental and symbolically charged elements in architectural design: the stair. Through a critical reflection on mythical and historical architectures, such as the Tower of Babel, which, according to Hegel, signifies the true inception of architecture. This study examines how stairs transcend their functional purpose. By engaging with a range of relevant edifices and conceptual frameworks, it situates the stair as a pivotal architectural device that meditates between movement, space, and meaning.

The analysis highlights that the stair should not be viewed merely as a technical or structural element, but as a dynamic form that embodies both physical and metaphysical aspects. In this context, stairs emerge as architectural constructs that enable new ways of perception and interaction, allowing individuals to forge novel relationships with their environment and their own experiences. The project ultimately results in a design proposal submitted to an international competition, where theoretical exploration and practical implementation come together to reaffirm the cultural and existential importance of the stair within contemporary architectural dialogue.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 6, 2024.

Paper 6

A Comparative Study of Art Deco Architecture in Budapest and Shanghai

H. Li[1], **B. Baranyai**[2], **M. Halada**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Pécs, Hungary*
[2]*Faculty of Engineering and Information Technology, University of Pécs, Pécs, Hungary*

Keywords: art deco, Shanghai, Laszlo Hudec, Hungarian architecture

This study examines the similarities and differences between Art Deco architecture in Hungary - particularly in Budapest - and Shanghai. In Hungary, Art Deco architecture evolved from earlier Secessionist and Bauhaus tendencies, shaped by the socio-economic challenges following World War I and the Treaty of Trianon. In contrast, Shanghai's Art Deco boom during the 1920s-1930s was driven by rapid urban growth, international trade and colonial concessions that introduced Western architectural ideas. Iconic buildings for example, the Park hotel and Zhenguang Guanxue building. The study further explores how these stylistic differences stem from divergent socio-political contexts - Hungary's post-imperial reconstruction versus Shanghai's semi-colonial cosmopolitanism - and how international architectural exchanges shaped their respective Art Deco expressions.

Today, while many Art Deco buildings in both cities face challenges of urban redevelopment, increasing awareness of heritage value has prompted restoration efforts. Budapest's conservation initiatives focus on integrating historical façades into modern urban life, while Shanghai's adaptive reuse projects have revitalized landmark buildings for cultural and commercial use.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 7, 2024.

Paper 7

Architectural Regeneration on a Construction Waste Landfill

X. Jin[1], **K. Jiao**[2]

[1]*Department of Visual Studies, Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Institute of International Education, University of New Era, Malaysia*

Keywords: architectural regeneration, adaptive reuse, site-specific design, topography, landscape integration

This study presents an architectural practice that transforms a disussed tool shed on a challenging site, a slope formed by a construction waste landfill in China, into a complex that integrates a community clubhouse and boutique guest accommodation. The project addresses a fundamental architectural question: how to turn site constraints, including an unstable foundation and a pre-existing structure, into design drivers, while enhancing its dialogue with the surrounding vineyard and mountain landscape.

The design methodology is based on a site-responsive approach. Firstly, a raft foundation was employed as a unifying structural strategy to stabilise the heterogeneous ground, transforming a technical constraint into a precondition for construction. Secondly, the design engages with the topography through vertical superimposition. The original structure was reinforced to serve as the base for the guest accommodation, while a new clubhouse volume was elevated above it, oriented towards the optimal views. This strategy not only facilitates functional reprogramming but also constructs a straightforward spatial narrative, a solid base rooted in the earth, contrasted with a light, panoramic upper level reaching towards the landscape.

At the building-environment interface, a full-height glazing on the south elevation frames the distant mountains, achieving visual continuity. Meanwhile, a strategically planted bamboo screen acts as a semi-transparent ”ecological filter”, softening the presence of the new volume and creating a dynamic, time-based facade. This practice demonstrates that a site-specific design methodology can seamlessly integrate technical logic, functional needs, and perceptual experience. It offers a replicable design paradigm for low-impact, high-quality architectural regeneration within the context of sustainable urban renewal.

Figure 7.1: On-site photograph of the extension

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 8, 2024.

Paper 8

Balancing Abundance and Need: Daylight, Human-Centric Lighting and Sustainable Housing in the Middle East

L. Esau, E. S. Zoltán

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: daylight, sustainable residential design, energy efficiency, architectural lighting

This study examines how the combination of natural light and human-centric lighting (HCL) can improve sustainable residential design, benefiting both energy efficiency and human's well-being. In contemporary housing, natural light is often obstructed by high population density and artificial lighting solutions rarely mimic the patterns of natural light. Drawing on findings from environmental psychology and traditional building methods that made the most of sunlight, this research investigates the dual aspects of natural light as both a positive influence and a possible disturbance especially in areas like the Middle East, where strong sunlight can either enhance or compromise comfort. The goal of the research is to develop architectural methods and design models that integrate daylight optimization with flexible HCL systems across various types of housing. By merging digital modeling (BIM) with surveys focused on the experiences of occupants, the project aims to create actionable design recommendations for architects and policymakers. The expected results include a framework for harmonizing natural and artificial lighting to promote circadian health, lower energy consumption, and foster adaptable, sustainable residential settings.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 9, 2024.

Paper 9

Lighting Design from the Perspective of ”Great Health”

S. Xiao, A. Tamás

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: lighting design, "Great Health"

”Great Health ”is a global concept proposed in the 21st century based on the development of the times, social needs and changes in the spectrum of diseases. It revolves around people’s clothing, food, housing, transportation, as well as their birth, aging, illness and death, focusing on various risk factors and misconceptions that affect health. It pursues not only individual physical health, but also complete mental, psychological, physiological, social, environmental, moral and other aspects of health. In current environmental design, how to make environmental space serve human health is an area that designers need to ponder and explore. The research focus of this project is on how to incorporate cultural elements based on human environmental psychology to make environmental design serve human health. Lighting design refers to the process of creating lighting solutions that meet visual functions, comfort experiences and atmosphere creation through reasonable planning of light sources, lighting fixtures and control methods based on the functions, usage needs and environmental conditions of buildings. The lighting environment requirements of building health standards mainly focus on how to improve human health, comfort, and productivity through reasonable lighting design. At the same time, this is also an important part of environmental health in the concept of ”Great Health”.

People often experience changes in their emotions and psychological states under different lighting environments (natural light or artificial lighting), therefore contemporary designers need to fully understand how light design affects people’s physiological reactions and emotional perception in order to meet the needs of ”environmental health”. Lighting design not only affects visual aesthetics, but is also deeply intertwined with our emotions. From color therapy to modern lighting design, the color of light can regulate emotions, relieve stress, and even promote physical and mental health.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 10, 2024.

Paper 10

Not a House but a Home - Architecture and Information Technology in the Service of Social Responsibility

T. Z. Dányi, K. F. Nightngale

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: social sustainabilty, solidrity architecture

This project presents a digital platform designed to connect architects, architecture students, and IT developers in exploring and realizing new forms of socially responsible architecture. The web-based initiative (nahbah-frontend) provides a collaborative environment where participants can share design ideas and practical solutions for building shelters from freely available, leftover or recycled materials or for improving the comfort and safety of existing homeless dwellings.

The project builds upon the pedagogical tradition that integrates social sensitivity and ethical awareness into architectural education. It aims to demonstrate how digital tools can extend the architect's social agency beyond the classroom and into the public sphere. What makes the initiative distinctive is the close collaboration between architecture and informatics - disciplines that rarely meet, yet together can generate new models of participatory and inclusive design practice.

By merging digital technology with architectural thinking, the project seeks to create a dynamic archive and discussion platform that promotes sustainable, affordable and human-centered spatial solutions. It also acts as an educational experiment: a medium through which students learn not only to design spaces, but to engage critically with issues of homelessness, resource scarcity and environmental responsibility.

Ultimately, "Not a House But a Home" proposes a redefinition of architectural practice as a socially and ecologically conscious act. It invites the next generation of designers to take part in shaping a culture of solidarity, where architecture serves not prestige or profit, but the shared dignity and well-being of all.

Figure 10.1: The homepage of the "Not a House, But a Home" website.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 11, 2024.

Paper 11

Integrating SLR and Expert Evaluation through FAHP for Assessing Holistic School Building Design Strategies across Climate Zones

K. Dedar Salam, T. J. Katona, B. Baranyai

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: Fuzzy Analytic Hierarchy Process (FAHP), holistic design approach, school buildings, climate zones

Developing sustainable and climate-responsive school buildings requires a well-balanced integration of environmental, functional and social factors. This study introduces a comprehensive framework that combines a Systematic Literature Review (SLR) with expert judgment and the Fuzzy Analytic Hierarchy Process (FAHP) to identify and evaluate the most effective holistic design approaches for school buildings across various climate zones. The SLR methodically compiles existing research to establish a set of key evaluation criteria, which include architectural design, passive and active systems, materials, energy strategies, and indoor environmental quality. Expert contributions are integrated to refine these criteria and address uncertainties related to qualitative assessments through fuzzy logic. The FAHP technique enables the quantification of expert preferences, yielding weighted priorities that reflect the relative significance of each design aspect in differing climatic contexts. The results reveal distinct hierarchies of design strategies tailored to hot-arid, temperate, cold, and tropical climates, highlighting the importance of contextual adaptation in achieving sustainability objectives. The proposed framework serves as an invaluable decision-support tool for architects, policymakers, and planners seeking evidence-based and adaptable design strategies for educational buildings. This research advances integrative assessment methods that connect literature synthesis with expert-driven evaluation in the pursuit of sustainable built environments.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 12, 2024.

Paper 12

Analyzing Adaptability in Office Typologies: Toward Sustainable and Flexible Design Strategies

D. M. A. Abu-Lail[1], **E. S. Zoltán**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: office typologies, adaptability, sustainable design, flexible workspaces, rehabilitation, multi-use offices, quantitative analysis, design methodology

This study examines the adaptability of different office typologies as a foundation for developing sustainable and forward-thinking design approaches. Office structures vary in the organization of space, flexibility, and capacity to accommodate emerging functional and environmental demands, making the assessment of adaptability critical in the context of well-informed rehabilitation planning. This study introduces a systematic, measurable technique to measure adaptability against critical parameters: spatial flexibility, reconfigurability, energy efficiency, transformation cost, and user satisfaction. All the parameters are graded, normalized, and given weights to give an overall Adaptability Index (AI) for relative comparison. Spatial parameters such as floor plate efficiency and modular grid potential are also included to facilitate measurable and actionable feedback. By transforming qualitative evidence to quantitative information, this exercise not only facilitates strong comparisons of typologies but also lends itself very readily to the development of a new method for sustainable, adaptable office design.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 13, 2024.

Paper 13

Adaptive Design of Kindergarden Built Environments under the Eco-Friendly Concept

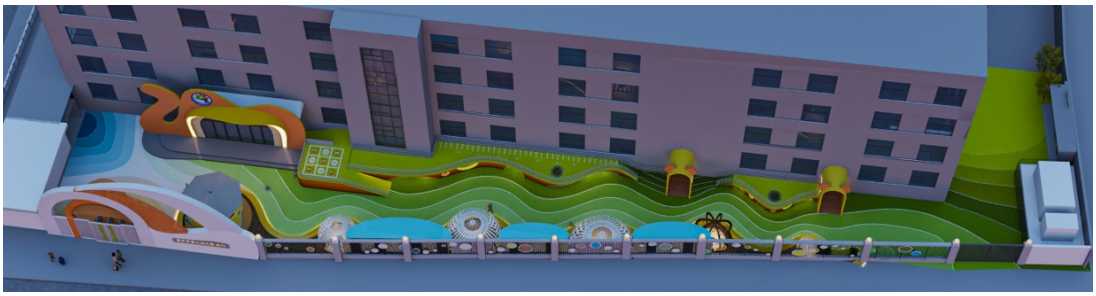
H. Cao[1,2]

[1]*Jinzhong University, China*
[2]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: kindergarten, built environment, eco-friendly, adaptable

China is currently undergoing a critical period of enhancing quality and expanding access in preschool education. Within this context, the concept of ”eco-friendliness” is progressively shifting from a peripheral notion to a central principle in kindergarten architectural design and environmental creation. It has become a significant dimension in responding to the national action plan for developing and enhancing inclusive preschool education and in achieving sustainable development goals. Consequently, under this backdrop, the development of eco-friendly kindergartens is evolving beyond a singular focus on technical energy conservation. It is advancing towards the construction of a multi-dimensional educational ecosystem that integrates ”environment, curriculum, and experience”, demonstrating a holistic evolution from the physical kindergarten setting to educational substance, and from resource utilization to life-centered care.

Guided by the ”eco-friendly” concept and grounded in the current developmental landscape of preschool education in China, this study thoroughly examines the policy drivers and evolutionary trajectory of ecological design in Chinese kindergartens. It places particular emphasis on exploring the innovative integration and practical pathways of eco-friendly principles in kindergarten architectural and environmental design. Through this research, we aim to provide new momentum for improving the quality of preschool education in China, facilitating a transition where eco-friendliness evolves from an exceptional feature to a standard practice. Additionally, it seeks to contribute unique Chinese practices and indigenous wisdom to the ecological design of children’s learning environments worldwide.



Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 14, 2024.

Paper 14

Study on the Assessment of the Built Environment of Community Centers and Optimization Strategies from the Perspective of Urban Health Examination

A. Greg[1], D. Zhao[2], Y. Qian[2], W. Gong[2], Y. Wu[3], H. H. Liang[4]

[1]*University of Pécs, Hungary*
[2]*Beijing Forestry University, China*
[3]*Beijing Insititute of Architectual Design CO..LTD, China*
[4]*Tangshan University, China*

Keywords: urban renewal, urban health, parameterized simulation

As China's Urban renewal enters a phase of high-quality development, urban health examination has evolved into a multi-dimensional assessment framework covering the "urban area-block-community-housing"hierarchy. Architecture is the smallest analytical unit in urban health examination. Within the "community" dimension, the focus is mainly on community centers. As the core building carrier of the "community" dimension, the community center often undertakes the supporting service functions of residents' leisure, sports and education, and is used to improve the "community" public service system. Against this backdrop,this study clarifies the pivotal value of community center assessment under the "community" dimension of urban health examination. Drawing on international standards and relevant literature, it refines and enhances the evaluation index system for natural ventilation and daylighting in community centers, develops a full-process optimization evaluation model covering "data extraction-problem diagnosis-renovation optimization", and realizes multi-dimensional problem diagnosis by leveraging parametric simulation technology. On this basis, it puts forward targeted renovation recommendations. Through parametric simulation technology, the study achieves multi-dimensional problem diagnosis and provides targeted renovation recommendations.Leveraging parametric simulation technology, this study realizes multi-dimensional diagnosis of environmental issues in community centers and proposes targeted renovation recommendations. Taking Ziyunnanyi Community Center in Beijing as a case, this study employs the parameterized simulation model to simulate the center's daylighting and ventilation performance. Based on the simulation results, it formulates tailored optimization schemes to address identified deficiencies. This study offers a new technical pathway for community center assessment from the perspective of urban health examination, and contributes to refined urban governance.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 15, 2024.

Paper 15

Integrating Heritage Protection Research into Architectural Education: Adaptive Reuse and Revitalization in Practice-Based Learning

A. Greg

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: adaptive reuse, architecture, vacancy, reuse, rehabilitation, heritage

The research presented in this paper focuses on the integration of the International Integrated Heritage Protection Research Team's results into academic architectural education at both BSc and MSc levels. The phenomenon of building vacancy has become a significant urban and architectural challenge, as many disused buildings also represent valuable cultural heritage. Addressing this issue requires a complex understanding of preservation, adaptive reuse, and sustainable revitalization strategies.

Our aim is to bridge the gap between academic research and architectural education by embedding current heritage protection methodologies into existing design studio courses and related theoretical subjects. Through this approach, students engage with real-world projects involving empty or underused heritage buildings, allowing them to test and apply research-based methods in adaptive reuse, reactivation, and context-sensitive architectural interventions.

The paper outlines the pedagogical framework and teaching methods developed to foster interdisciplinary collaboration and research-based learning. Case studies illustrate how integrating research outcomes into education not only enriches student competence but also contributes to the long-term preservation and sustainable reactivation of built heritage.

This model demonstrates how architectural education can actively respond to the challenges of urban transformation and cultural continuity through a research-informed, practice-oriented learning environment.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 16, 2024.

Paper 16

Interior Design Support of Function through the Presentation of Three Projects

S. Jurdik[1], **Z. Bittner**[2], **G. Medvegy**[1], **Á. Borsos**[1],

[1]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: interior design, functional spatial design, environmental psychology, colour dynamics, material usage, visual communication, comfort, user experience

The exploration of psychological and aesthetic correlations in functional spaces has become one of the defining questions of contemporary interior architecture.

Through three projects of different functions - the Bóly Health Centre, the Student Union corridor of the Faculty of Engineering and Information Technology at the University of Pécs, and the Cybersecurity Centre in Building D of the Nyár Street campus - the study demonstrates how colours, materials, textures and graphic elements can enhance both the functional and psychological effectiveness of interior spaces. The presented works seek a balance between functional requirements and emotional perception: aesthetic decisions become tools carrying not only formal but also spatial and emotional meaning.

The examples of function-oriented interior design clearly illustrate how the conscious composition of visual communication, colour dynamics, and material selection contributes to user experience, spatial identity, and comfort.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 17, 2024.

Paper 17

Study on the Application of Spatial Scale in Interior Aging-Friendly Design

Q. Cui[1], **P. Zilahi**[2], **X. Jin**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[2]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: residential design, spatial scale, aging-friendly design

With the rapid aging of the global population, optimizing spatial scale in aging-friendly interior design has become critical for enhancing older adults' quality of life and independence. Improving elderly living environments involves more than physical accessibility; it requires a systematic approach that coordinates multiple factors. A well-designed aging-friendly space should ensure barrier-free movement and wheelchair accessibility while integrating fall prevention, spatial circulation, lighting and acoustic control, emergency response layout, functional zoning, spatial openness, and psychological comfort.

Most existing studies focus on single-factor solutions, emphasizing local functional improvements but lacking holistic integration. In practice, conflicts often arise among spatial elements—for example, increasing storage may reduce circulation width, or improving daylighting may compromise privacy. Therefore, a multi-objective optimization approach capable of dynamically balancing these factors is essential to enhance overall spatial quality.

This study proposes a multi-objective optimization strategy centered on spatial scale, incorporating ergonomic standards, psychological characteristics, and spatial adaptability of older adults. The strategy aims to optimize indoor layout dimensions to satisfy safety, comfort, functionality, and spatial efficiency, achieving wheelchair accessibility, fall-risk control, spatial fluency, and functional rationality. Using literature review, field surveys, and simulation modeling, key dimensional parameters affecting safety, comfort, and efficiency in typical residential spaces—such as bedrooms, bathrooms, and living areas—are identified. The results provide quantitative guidance for spatial layout, circulation organization, and furniture arrangement, offering practical and theoretical references for aging-friendly residential design.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 18, 2024.

Paper 18

Adaptability of Living Spaces to Changing Life Situations

D. Szurduk

Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: sustainable urban living, adaptive reuse, flexible use of space, architectural modularity, structural flexibility

Housing has always been a basic need in human society. However, in the 21st century, housing patterns have undergone significant transformations due to global urbanization, rapid technological development, and young people's demands for new lifestyles. Digital nomads, university students, young professionals, and those seeking flexible work opportunities are increasingly interested in new types of housing. Striking a balance between short-term, temporary, and long-term housing patterns and focusing on sustainability are all central issues in the design of future cities. The following presentation aims to comprehensively examine the housing needs of young adults in the 21st century, the impact of different housing patterns on mental well-being, and the role of sustainability in housing design.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 19, 2024.

Paper 19

Exploring Smart Community Development Strategies in the Context of Old Residential Area Renovation

Z. Li

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: Smart Community, renovation of older residential areas, digitalisation

As China's urbanization process continues to advance, the renovation of older neighborhoods has become a key issue in urban renewal. These communities commonly face challenges such as outdated property management practices, poor environmental hygiene and ageing public facilities. This not only fails to provide residents with a high quality of life but also hinders the improvement of the city's overall image and development standards. Amidst the rapid advancement of artificial intelligence and its pervasive integration across diverse sectors, the emergence and application of the smart community concept offer novel approaches and methodologies for revitalizing ageing neighborhoods. This facilitates their seamless integration into contemporary urban living. This paper proposes recommendations for renovation pathways and design strategies for ageing communities, grounded in the objectives of smart community development, with the aim of providing practical guidance for relevant implementation.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 20, 2024.

Paper 20

Analysis of Apartments in the Retfala Nova Settlement: Case Study of Osijek

D. Koški[1], **I. Brkanić Mihić**[1], **E. S. Zoltán**[2], **N. Ramos Gonzalez**[2]

[1]*Faculty of Civil Engineering and Architecture, Josip Juraj Strossmayer University of Osijek, Croatia*
[2]*Breuer Marcel Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: quality of apartments, housing design, apartment layout, spatial characteristics, Osijek

Housing is one of the most significant factors shaping the quality of life for individuals and communities. A well-organized and high-quality living space provides a sense of security, stability, and privacy, while positively influencing the physical and mental health of its residents. The aim of this study is to analyze the apartments within the residential settlement of Retfala Nova in Osijek. The primary research objective is to investigate the spatial and functional characteristics of the apartments, with a particular focus on their orientation towards sunlight, ventilation, and internal spatial arrangement. The analysis of all apartments in the settlement indicates that a significant number of units have a three-sided orientation, providing optimal sunlight exposure and effective natural ventilation. The findings offer valuable insights into the existing residential typologies within Retfala Nova. It forms a small part of a broader research project about housing development in Osijek. These results will serve as a foundation for further research within a forthcoming doctoral dissertation, focused on the evolution of residential architecture in the city of Osijek.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 21, 2024.

Paper 21

Reimagining Historical Preservation: The Erbil Citadel Houses as a Model for Adaptive Heritage Reuse

W. A. S. Goriel[1], **T. Molnár**[2], **E. S. Zoltán**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: Erbil Citadel, architectural preservation, sustainable heritage, adaptive reuse

A land abundant in history and vital to the future, it must find a way to balance preserving the past with inspiring a future that avoids making everything seem quaint and outdated. This paper examines the reimagining of architectural heritage in non-traditional ways, drawing on a case study of houses within the Erbil Citadel. Evidence dating back 6,000 years marks the Erbil Citadel as possibly the world's oldest continuously inhabited settlement. It is demonstrated in its architectural wonders and centuries-old houses, many of which struggle to maintain authenticity while meeting the demands for modern reuse. Against this realization is a reflection on what traditional building techniques might be re-manifested using Modern-day materials and processes, highlighting the significance, integrity, and contemporary relevance of reused heritage places. This methodology demonstrates that cultural narratives can be preserved while accommodating modern usage through adaptive reuse, with a focus on the functional aspect of the buildings as a key factor in selecting the new use.

It studies a few selected houses in the Citadel as examples to show how the new methodology of selecting new use techniques could be applied in traditional layouts anywhere, leading to the revival of heritage structures.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 22, 2024.

Paper 22

The Symbolic System of Small-Town Hungarian Architecture - The Transformation of the Sándor Petőfi Cultural Center in Kiskőrös

Z. Bittner[1], S. Jurdik[2], G. Medvegy[2], Á. Borsos[2],

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: small-town architecture, system of symbols, local identity, spatial relations, architectural heritage, contemporary Hungarian architecture, Petőfi Sándor Cultural Centre, Kiskőrös

The study examines the system of symbols in small-town Hungarian architecture and its contemporary application through the case of the Petőfi Sándor Cultural Centre and City Library in Kiskőrös. The research aims to explore how traditional architectural elements of small-town heritage can be integrated into contemporary public buildings to strengthen local identity. The applied methodology combines literature review and architectural case study analysis, focusing on the role of historical references in the development of design concepts. The findings indicate that the new cultural centre in Kiskőrös consciously continues the city's architectural traditions: its vertical articulation emphasizes the representative role of the building and establishes a dialogue with the surrounding church towers, while its façade composition and material use evoke, in an abstract manner, the characteristic features of traditional civic architecture. The massing of the building fits harmoniously into the historical urban fabric, aligning with the spatial rhythm and scale of the Petőfi Square and its adjacent buildings. The analysis reveals that the creative reinterpretation of traditional architectural symbols within a contemporary framework can result in an emblematic, site-specific public building. It can therefore be concluded that the values of local architectural identity and heritage can successfully be carried forward in contemporary design practice, reinforcing both community belonging and urban character.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 23, 2024.

Paper 23

Modular Renovation of Community Healthcare Centre Wards: Infection Control Zoning and Dual Circulation

Z. Fu, X. Jin, D. Rétfalvi

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: Community Healthcare Center, modular transformation, clean-dirty zoning, dual-circulation pathways

The World Health Organization (WHO) has warned of a clear global risk of recurring epidemics, highlighting the importance of epidemic prevention capacity in primary healthcare facilities. In China, Community Health Centers (CHCs), as the frontline of disease control, generally face issues such as limited space, unclear zoning and poor ventilation in their aging wards, making them unable to meet infection-control requirements for temporary admission of infectious diseases. This has led to the coexistence of idle resources in the community and overcrowding in specialized hospitals during outbreaks. However, traditional renovation approaches are characterized by long cycles and high disruption, making them unsuitable for emergency needs.

To address this, this study proposes an infection-control-oriented modular ward renovation design method. Guided by the core principles of ”infection-control compliance, functional flexibility and low operational disruption”, the method establishes a three-level modular system of ”zoning interface-circulation pathways-spatial functions”. It integrates key technologies such as modular partition systems, dedicated ventilation and smart equipment panels and follows a ”factory prefabrication-on-site rapid assembly” pathway to achieve resilient conversion of general wards into temporary infectious disease admission spaces.

This paper systematically elaborates on the design logic and technical framework of the method and demonstrates how it can achieve strict zoning and flow separation within constrained spaces. It provides an operable technical pathway to enhance the graded triage capacity of primary healthcare facilities during public health crises and to strengthen resilience in integrating regular and emergency medical functions.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 24, 2024.

Paper 24

Exploring Variable Acoustic Strategies in Concert Halls: Geometric, Material and Structure

Y. Tang[1], **M. Halada**[2], **P. Paári**[2]

[1]*Marcel Breuer Doctoral School of Architecture, University of Pécs, Hungary*
[2]*Faculty of Engineering Information Technology, University of Pécs, Hungary*

Keywords: Variable Acoustic Environment (VAE), building acoustics, concert hall, room geometry, acoustic materials

The increasing functional diversity and performance requirements of modern concert halls have made fixed acoustic conditions insufficient for all musical and event types. Variable Acoustic Environments (VAEs), which allow flexible control of spatial acoustics, have thus become a forefront topic in architectural acoustics research.

This study investigates the implementation mechanisms of VAEs in concert halls and their impact on multi-functional performance. Three primary factors are analysed: adjustable room geometry, configurable acoustic materials and the unintended acoustic properties of VIP boxes. Using Pachyderm, different room geometries, variable absorption configurations, and VIP box states were modelled, and their acoustic performance was simulated via ray-tracing methods.

Results indicate that adjustable reflectors and movable ceilings significantly influence sound reflection and reverberation, while VIP boxes exhibit Helmholtz-resonator-like behaviour and coupling effects that modulate low-frequency sound fields. The findings provide a framework for designing concert halls with acoustically flexible environments, offering guidance for both theoretical research and practical applications in multi-purpose performance spaces.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 25, 2024.

Paper 25

Sound Energy Weighted Evaluation Method for Average Reverberation Determination

Y. Tang[1], **M. Halada**[2], **P. Paári**[2]

[1]*Marcel Breuer Doctoral School of Architecture, University of Pécs, Hungary*
[2]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: energy-weighted method, reverberation time, room acoustics, perceptual relevance

Reverberation time is a fundamental indicator of room acoustic quality. Conventional evaluation methods, however, do not fully balance contributions across all frequency bands. For instance, ISO 3382 commonly recommends using mid-frequency bands (500-1000 Hz) as representative metrics, whereas standards such as IEC 60268-16 apply fixed weighting schemes.

This study proposes an energy-weighted reverberation time (RTew) method for evaluating overall room reverberation. The method first acquires time-domain recordings of the room sound and converts them into the frequency domain via Fourier transform. By subtracting background noise energy from the fully occupied room energy, the net sound energy distribution across one-third octave bands is obtained. The sound energy in each band is then integrated to derive energy-based weighting factors for the corresponding center frequencies, which are subsequently applied to calculate a weighted average of the reverberation time.

The RTew method enables architects to select appropriate sound-absorbing materials more purposefully, effectively controlling room reverberation time. It avoids excessive absorption of high frequencies while preventing dominant energy bands from becoming acoustically muddled. The proposed evaluation approach demonstrates clear advantages in both early design stages and subsequent acoustic renovation of buildings.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 26, 2024.

Paper 26

Parametric Design and Environmental Simulations for Climate-Responsive Architectural Solutions

K. Varga

Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: shading design, daylight simulation, wind comfort, environmental performance, parametric modeling, sustainable architecture, Grasshopper, Ladybug Tools

One of the major challenges of contemporary architecture is to ensure comfort, sustainability and energy efficiency simultaneously. Solar radiation, daylight exposure, and wind comfort fundamentally influence the design of architectural and urban spaces. This study presents the application of parametric design and environmental simulations through three case studies: the tourism development of Sellye, a popular music venue in Debrecen, and the revitalization of the Pécs marketplace. The research demonstrates how sunlight and wind direction analysis, as well as the design of parametric shading systems, can be integrated into the early design process using Grasshopper and Ladybug Tools. The results highlight that the integration of environmental data and parametric modeling leads to architectural solutions that are not only aesthetically refined but also climatically optimized and sustainable.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 27, 2024.

Paper 27

Analyzing Adaptive Thermal Comfort Indoors in Jordan: An Experimental Study

S. Abdel-Salam[1], **B. Cakó**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Department of Building Services and Building Engineering, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: thermal comfort, predicted mean vote, housing, Jordan

Thermal comfort in residential buildings is a significant determinant of Indoor Environmental Quality (IEQ), as decline in thermal comfort indoors is a dominant cause of unhealthy conditions and Sick Building Syndrome (SBS) prevalence. Predicted Mean Vote (PMV) is the most widely used model to measure thermal sensation of a group of people, based on a seven-point scale. However, several research papers indicated its limitation to certain climates and building conditions, which neglects important impacting factors like adaptability and behaviour of building occupants. In Jordan, thermal discomfort in housing is caused by different factors including poor thermal insulation of building envelope. Some local research on thermal comfort relied on the adaptive thermal comfort model instead of the PMV, as supposed to give more accurate results in the Jordanian context. Although it considers natural ventilation and users' activity, but it is only suitable for moderate weather conditions in Jordan. This paper aims to suggest an extended model of the PMV index based on conducted lab studies on Jordanian participants. Thermal comfort measurements will include using a thermal comfort measuring station, a thermal manikin and a distributed questionnaire at the same time, to provide accurate assumptions based on a comparison between the resultant values.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 28, 2024.

Paper 28

Literature Review Establishing the Basis for Determining the Environmental Impacts of Residential Buildings

R. R. Szűrösné Ördög, T. Horváth, A. Veöreös

Széchenyi István University, Győr, Hungary

Keywords: HBIM, databases and software for LCA, building reconstruction

The research examined several papers in which researchers carried out renovations on buildings. The literature review summarizes research published in recent years in the field of assessing the environmental impact of buildings. It examined what methods, databases and software can be used to calculate the life cycle of buildings. The article contributes to a deeper understanding of the calculation of environmental impacts.

HBIM (Heritage Building Information Modelling) plays a special role in the modelling of buildings. In the case of historic residential buildings, in many cases there is no plan available from which calculations could be made. After the survey and processing, the HBIM model can be created, and there are already possibilities for its automation. During the research, residential building types from several eras were modelled, which will allow calculations to be made based on these in the future, as well as energy consumption and life cycle analysis of buildings.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 29, 2024.

Paper 29

A Review of Urban Small-Scale BIPV Public Building Projects (2021-2025)

S. Tong, A. Greg

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: BIPV, small-scale public building, statistical review

This paper is one of the important preliminary work for my graduation thesis, ”Maximizing Photovoltaic Building Design.” The thesis tries to answer the question, ”Does BIPV have realistic potential and economic feasibility for small-scale public buildings in cities, and are policies and market mechanisms forming supportive conditions?”. This paper systematically collects and analyzes case studies of BIPV projects in urban public buildings to form a review. Current literature lacks statistically significant reviews of public building BIPV projects. Even within industry reports and energy department announcements, relevant work is sporadic and often focuses on single or limited aspects such as installed capacity data and technological advances. Architects are more likely to encounter design-focused project introductions. Therefore, a statistical analysis of the characteristics of public building BIPV projects within a specific timeframe and space is lacking. This article will set the statistical scope based on project type and scale, installed capacity, investment subject, cost and benefit, policy support conditions, building type and use, spatial conditions and other aspects; crawl data from data sources such as design institutes and enterprises' public cases, government department project database, relevant industry and association research reports, bidding service platforms, design websites, etc.; sort out comparative information including regional differences and changing trends in project type proportions, and provide architects with experience and parameter basis for photovoltaic project design.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 30, 2024.

Paper 30

Exploring the Adaptability of Housing through Sustainable Solar Decathlon Europe Housing Prototypes

D. Ojo[1], **Á. Borsos**[2], **G. Medvegy**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: Solar Decathlon Europe, adaptability, sustainability, architectural innovation, housing

The Solar Decathlon Europe (SDE) is widely recognized as a global platform for advancing innovation in sustainable housing through full-scale prototype construction and rigorous performance assessment. The resulting experimental dwellings embody leading principles of energy efficiency, environmental responsibility, and material optimization, making them highly relevant to achieving the 11th UN Sustainable Development Goal of creating more sustainable cities and communities. However, despite their technological sophistication, these prototypes often reveal a significant gap: sustainability in such models tends to prioritize performance efficiency over adaptability, resulting in highly innovative houses yet limited in their capacity to evolve with changing spatial and social needs.

This paper analyzes prototypes from the most recent Solar Decathlon Europe competitions, identifying strategies that implicitly support adaptability while also exposing the systemic constraints that prevent their full realization. The analysis is framed through established theories of adaptable architecture and sustainability frameworks, allowing for a critical comparison between competition-based innovation and long-term housing viability.

The findings point toward a new synthesis where adaptability is treated not as a secondary consideration but as a dimension that is fundamental to a truly sustainable built environment. It suggests that a balance must be struck between sustainable solutions for housing and the adaptability of the solutions. The paper concludes by proposing methodological pathways for integrating adaptability principles at the core of experimental housing frameworks, bridging the gap between temporary innovation and lasting architectural relevance.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 31, 2024.

Paper 31

Adaptive Approaches to Sustainable Urban Housing: The Case of Pécs

H. Tomajian[1], **J. Gyergyák**[2]

[1] *Marcell Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[2]*Department of Architecture and Urban Planning, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: adaptability, sustainable housing, post-industrial cities, urban reseliance

Building on prior analysis of adaptive urban futures and examined context of Damascus, this study investigates adaptable approaches that can serve as a pathway to sustainable urban housing. By focusing on the city of Pécs in Hungary as a case study, this research explores innovative design strategies that integrate sustainability and adaptability into urban housing contexts. Pécs' urban fabric records long, layered processes: Roman and medieval settlement forms; 150 years of Ottoman urban imprint; Habsburg/19th-century industrialization that reshaped the city plan; large-scale socialist housing and industrial planning in the 20th century; and post-1990 transitions where cultural-led regeneration has been a central strategy for urban renewal. Drawing on the developed framework and insights from Future Urban Living, the study identifies key principles for fostering vibrant, adaptable, and resilient living environments. Through:

- Examining existing urban housing typologies and their evolution within Pécs' post-industrial context.
- Analyzing Innovative sustainable housing projects, such as the energy-positive "Reborn Home" prototype that produces more energy than it consumes.
- The Adaptive student housing solutions that respond to the city's university population needs.
- The comprehensive renovation of socialist-era housing blocks demonstrates structural adaptability through spatial reconfiguration.

That provides architects and urban planners with approaches for designing future-ready urban housing that responds to demographic shifts, environmental challenges, and evolving needs.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 32, 2024.

Paper 32

The Alleyway as a Catalyst: Reinterpreting Naples' Urban Culture for Contemporary Community Design

T. Shi

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: Naples, micro-space regeneration, alleyway culture, community, architectural design

This study focuses on the micro-spatial regeneration of historic districts and marginal areas. The next phase of the project will employ a control-variable case study methodology, selecting cities such as Naples and Genoa. As a foundation for the research, this report reviews existing studies on Naples' alleyway culture, examining its historical evolution, spatial organization and role in sustaining community identity. It also explores characteristics of alleyway culture such as layered thresholds, mixed public-private spaces, and informal interactions and how they offer insights for contemporary community center design. The findings contribute to architectural theory and community building design, providing insights into how traditional community culture can be applied to architectural design.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 33, 2024.

Paper 33

City-Scale Analysis of a Deteriorated Urban Area in the Context of Pécs' Urban Development Strategies

D. Hetesi[1], **D. Kalkán**[1], **J. Gyergyák**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[2]*Department of Architecture and Urban Planning, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: urban regeneration, analysis, sustainable urban development, urban strategy, decision-making

The research aims to provide a comprehensive, city-scale analysis of a deteriorated urban area that shows signs of social and physical decline, examined within the context of Pécs' current urban development strategies. The study analyses not only the physical characteristics of the site but also its urban structure, transport connections, green spaces, and social layers. Through this complex evaluation, the research identifies the area's strengths, weaknesses, and spatial potentials, helping to define possible directions for future renewal. The main objective is to detect and interpret the relationships between strategic, city-scale development concepts and the present urban condition.

The research methodology is based on the classification of urban development principles and the identification of their spatial manifestations. This approach contributes to a clearer understanding of the differences between strategic plans and real urban conditions, providing a basis for better coordination between decision-making and planning processes. The results may support communication among urban actors - including local government, developers, communities and professionals - and help to establish a shared vision for the area's sustainable renewal.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 34, 2024.

Paper 34

Green Retrofitting Strategies for Industrial Heritage in Urban Regeneration: A Case Study of the Ship Model Factory in China

W. Cheng

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: industrial heritage, green retrofitting, building performance, urban regeneration, sustainable design

In China, many industrial heritage sites face dual challenges of spatial decay and ecological degradation. Integrating these idle industrial areas into sustainable urban renewal has become an urgent task. This study takes the renovation project of the former Ship Model Factory of the Yangtze River Shipping Research Institute in Wuhan as a case. Through investigations into the site's history, culture, and current problems, combined with design simulation, this study explores a green framework and strategy for the protection and ecological regeneration of industrial heritage. The research aims to integrate historical preservation with ecological design to establish a renewal approach suited to China's urban context. The results propose a "heritage-ecology-community" collaborative framework and adaptive strategies for graded renovation, achieving both historical continuity and ecological efficiency while enhancing community vitality. The study provides a practical reference for the sustainable transformation of similar industrial relics.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 35, 2024.

Paper 35

Adaptive Reuse for Strengthening Rural Identity

G. Szecsei

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: adaptive reuse, cultural heritage, sustainable architecture, urban revitalization, tourism development

The aim of adaptive reuse is to preserve abandoned or underutilized buildings by integrating new functions that maintain their historical values while adapting them to contemporary needs. The Santa Maria del Piano Abbey in Italy serves as an excellent example of how a ruined building can be transformed into a multifunctional space that turns the relationship between past and present into a valuable touristic experience. The concept combines the preservation of local heritage, the use of sustainable materials, and the rethinking of community functions, creating a unique cultural and spiritual experience. This approach can also serve as inspiration for small and medium-sized towns in Hungary, where the lack of urban attractiveness, identity, and community engagement is a common challenge. The research aims to explore how these towns can become more livable, touristically appealing, and socially inclusive through architectural reuse, green space interventions, and the adaptation of international best practices. The Santa Maria del Piano Abbey project thus represents not only a local revitalization initiative but also a transferable model for how Hungarian rural towns can enhance their livability and touristic competitiveness through the conscious rethinking of the built environment and the contemporary utilization of heritage values.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 36, 2024.

Paper 36

Scaling Sponge City Strategies: Policy, Financial and Governance Pathways for Urban Water Resilience

L. Ben Khadra

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: Sponge City strategies, urban water resilience, sustainable stormwater managment, policy integration, financial incentives

The increasing frequency of extreme weather events, rapid urbanization, and inadequate stormwater infrastructure pose significant challenges to European cities. Sponge City strategies, which integrate nature-based solutions (NbS) such as permeable pavements, green roofs and urban wetlands, provide a sustainable alternative to traditional drainage systems. However, large-scale implementation remains constrained by fragmented policies, financial limitations, and governance inefficiencies. This paper presents an expanded framework for scaling Sponge City elements through strengthened regulatory frameworks, innovative financial mechanisms, and integrated urban planning approaches. By aligning Sponge City strategies with EU directives, promoting multi-level governance and leveraging emerging technologies, European cities can transition toward climate-adaptive, water-resilient urban environments. Drawing from case studies in Berlin, Copenhagen and Malmö, this paper outlines key recommendations for policy integration, economic feasibility, and long-term sustainability.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 37, 2024.

Paper 37

Mapping Toolchains in Positive Energy District Cases

Á. Magyari[1], **G. Medvegy**[2], **A. Reith**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering, and Information Technology, University of Pécs, Hungary*
[2]*Department of Architecture and Urban Planning, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: Positive Energy Districts, tool-chains, interoperability

Positive Energy Districts (PEDs) rely on multidisciplinary toolchains spanning urban planning, building physics, energy systems, mobility, and governance. Yet tools are often selected and combined ad hoc, with weak interoperability across scales (building-district) and lifecycle stages (planning-design-operation). This study maps and analyses the toolchains actually used in PED practice by systematically reviewing COST PED-EU-NET cases.

We define a toolchain as an ordered combination of tools/methods/standards used to answer a decision need at a given stage and scale. Tool mentions are extracted from COST case documents (software, standards, methods) and aligned with projects' stakeholders, lifecycle stages, and scales. We then empirically identify toolchain archetypes, for example: (1) from early-planning to detailed design; (2) design chains combinining multiple scales (building and district level designs) (3) tool chains combinging design and operational phases. The analysis highlights tool gaps (e.g., limited support for governance metrics) and integration gaps (e.g., complicated data handoffs between models, indicator-harmonisation issues), and surfaces minimal interoperable bundles that cities can adopt per stage to reduce rework and ambiguity.

Deliverables include a framework of tools organised along stakeholders, scales and lifecycle stages; and a catalogue of tool-chains.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 38, 2024.

Paper 38

A Typological Analysis of Public Space Networks in Chinese and Hungarian Settlements for Fostering Local Identity

X. Li[1], **T. Zhao**[2]

[1]*Faculty of Engineering and Technology, University of Pécs, Hungary*
[2]*Hubei University of Technology, School of Art and Design, China*

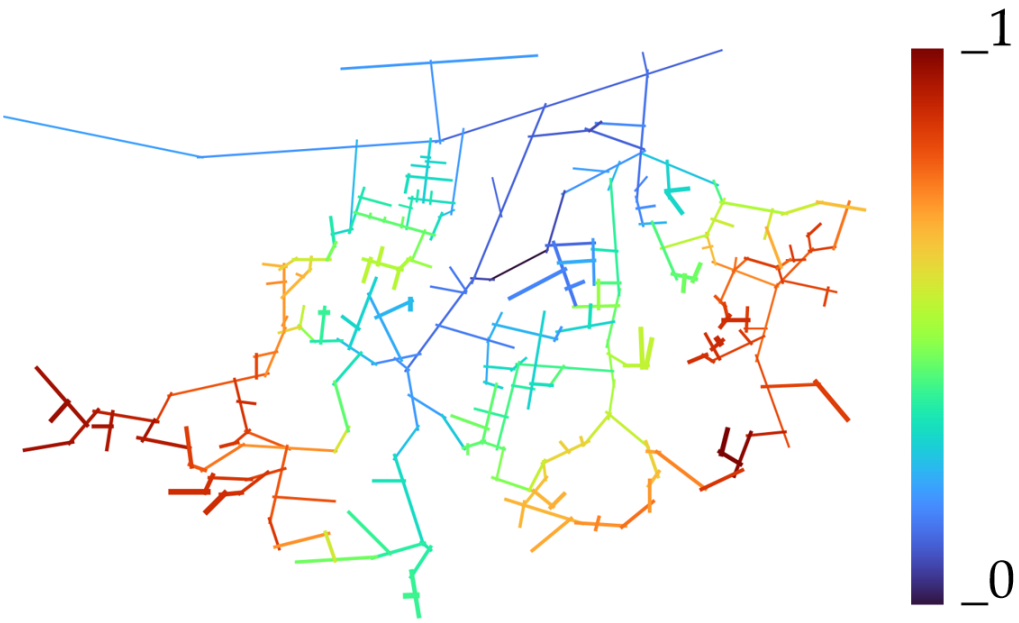
Keywords: traditional settlements, public space network, cross-cultural comparison, socio-spatial structure

The pervasive homogenization of community landscapes and social fabrics in newly developed urban areas of China has led to a weakening of local identity. The study aims to analyze the configurations of public space in Chinese settlements and explore analytical methods, seeking to move beyond mere spatial replication and provide theoretical support for building communities with local distinctiveness.

The core research question is how to classify and understand the network structures of public space in Chinese settlements systematically and validate this analytical framework. Employing a cross-cultural comparative approach, we selected and analyzed various urban and rural settlement cases from both China and Hungary. Utilizing space syntax theory, we focused on two key quantitative measures of their public space networks: choice and integration.

Our findings reveal that a quadrant classification method, based on the mean values of choice and integration, effectively categorizes these networks into four fundamental types with distinct spatial tendencies. A significant discovery is that urban community settlements demonstrate high consistency within this classification, indicating convergent spatial structures. In contrast, traditional village settlements exhibit remarkable diversity, appearing across all four quadrants, reflecting their deep adaptation to specific geographical contexts and socio-historical backgrounds. This study classifies twelve specific settlements and interprets the underlying mechanisms behind their patterns in conjunction with human geography.

Ultimately, the value of this research lies in transcending the simple imitation of physical form. By uncovering the inherent topological structure of public spaces, it provides a crucial conceptual foundation and design insights for the "organic transplantation" of the dynamic social spatial patterns found in traditional settlements into new urban developments, thereby fostering a strengthened local identity.



Sanhe Village, Gansu, CN

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 39, 2024.

Paper 39

A Strategic Approach to Laser Scanning: Accuracy, Time and Data Complexity Balance - A Case Study

D. E. Simon[1,2,3], **M. B. Zagorácz**[2,3], **P. M. Máder**[2,3], **T. Jászberényi**[1,2,3], **N. Bakai**[1,2,3], **O. Rák**[2,3]

[1]*Marcel Breuer Doctoral School of Architecture, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[2]*BIM Skills Lab Research Team, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[3]*Institute of Smart Technology and Engineering, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: Building Information Modeling (BIM), laser scanning, architectural documentation, digitization

The integration of digital twins into building management systems has amplified the need for precise and efficient documentation, throughout a building's entire life cycle (from construction, to renovating). Laser scanning technologies have shown great potential in this field, allowing for the accurate digital capture of complex building geometries in high detail. They provide reliable support not only in documenting existing structures for renovation and modelling purposes, but also during construction-phase monitoring and as-built surveying.

As these technologies advance rapidly, they continue to offer new opportunities and areas of application. However, the reliability and usefulness of any survey strongly depend on the applied methodology, including the strategic planning of scanning positions, data accuracy, and post-processing efficiency. Establishing optimized workflows is therefore crucial to ensure that the vast amount of collected data can be effectively used for architectural modeling.

This research explores the practical aspects of applying laser scanning in large scale architectural documentation, focusing on time requirements, data handling, and workflow optimization. A comprehensive survey of a multi thousand square meter building served as a case study to assess challenges related to data volume and processing time. The findings aim to support the development of more efficient methodologies for integrating laser scanning into construction phases, as-built surveying, and architectural modelling.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 40, 2024.

Paper 40

Mapping and Optimizing Current Hungarian Heritage Processes through the Application of BIM Methodologies

T. Jászberényi[1,2,3], **M. B. Zagorácz**[2,3], **P. Máder**[2,3], **O. Rák**[2,3], **D. E. Simon**[1,2,3], **N. Bakai**[1,2,3]

[1]*Marcel Breuer Doctoral School of Architecture, Faculty of Engineering and Information Technology, University of Pécs*

[2]*BIM Skills Lab Research Team, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[3]*Institute of Smart Technology and Engineering, University of Pécs, Hungary*

Keywords: Heritage BIM, built heritage, digitization, optimization

With the ongoing digitization of the construction industry, a wide range of new technologies, tools, and methodologies has emerged, creating new opportunities for stakeholders across the Architecture, Engineering and Construction (AEC) sector. Today, Building Information Modeling (BIM) represents an essential component of many projects and in recent decades its principles have also been extended to the field of heritage conservation - commonly referred to as Heritage BIM. Hungary's rich historical legacy has given rise to a diverse and valuable built heritage. Alongside the protection of cultural assets, the preservation of the built environment itself plays an equally vital role. Heritage conservation and preservation have been embedded in Hungarian legislation since the 19th century. Although these legal frameworks have undergone significant changes over time, the education and professional practice of heritage preservation continue to occupy a prominent position within the field of Hungarian architecture.

This research examines the current processes related to heritage structures in Hungary, focusing on their practical and regulatory contexts. By identifying the shortcomings of the Hungarian national cultural heritage protection system - both in terms of its legislative framework, conventional and digital professional practices, and the broader digital transformation of the Hungarian AEC sector - the study seeks to propose strategic solutions and define the key parameters necessary for developing a comprehensive national Heritage BIM framework.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 41, 2024.

Paper 41

Semi-Automated Scan-to-HBIM: Reconstructing Classified Point Clouds into Geometry

R. Salah, N. Géczy, K. Ajtayné Károlyfi

Széchenyi István University of Győr, Hungary

Keywords: Scan-to-BIM, HBIM, point cloud modeling, semi-automated workflows, heritage documentation

Historic Building Information Modeling (HBIM) faces a significant challenge in efficiently converting dense point cloud surveys into usable digital models. The transition from raw point cloud data to structured BIM geometry remains a time-consuming and complex bottleneck. This paper introduces a semi-automated workflow designed to reconstruct architectural elements as Revit geometry from classified point clouds, using the capabilities of Rhino and Rhino.Inside.Revit.

The proposed methodology begins with pre-classified point clouds, where elements such as columns and walls are already isolated into distinct groups. Section boxes are strategically applied to these groups to extract precise outline polylines. These polylines are then used in Grasshopper to reconstruct simplified yet accurate 3D geometry. The resulting models are imported into Revit, where they are organized according to appropriate building element categories, establishing a robust foundation for subsequent parametric development. A case study focusing on the reconstruction of exterior chapel columns demonstrates the workflow's efficacy. The accuracy of the modeled geometry is evaluated against the terrestrial laser scanning (TLS) point cloud, and efficiency gains are compared with traditional manual Revit modeling. This semi-automated process significantly reduces repetitive effort, enhances modeling consistency, and remains accessible to users without advanced programming expertise. By bridging classified point cloud data with Revit's modeling environment, this research provides a practical advancement for Scan-to-HBIM workflows and establishes a foundation for further automation and parametric family generation.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 42, 2024.

Paper 42

Protectorate Heritage Buildings Coupled with Digital Twin-based Monitoring

S. Sakoudom[1], **A. Greg**[2]

[1]*Marcel Breuer Doctoral School, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[2]*Department of Architecture, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: adaptive reuse, digital twin, HBIM, timber modular, Phnom Penh, protectorate building

This research proposes a novel methodology for the adaptive reuse of French-colonial heritage buildings in Phnom Penh through the integration of reversible extensions and a digital twin monitoring system. The framework blends conservation ethics and local architectural tradition (New Khmer Architecture) with structural engineering and digital technology (HBIM/IoT sensing). This approach aims to achieve preventive conservation and structural resilience while aligning with UNESCO HUL principles, offering a scientifically rigorous protocol for non-intrusive, culturally sensitive, and climate-adaptive heritage intervention in a Southeast Asian context.

Civil Engineering

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 43, 2024.

Paper 43

Automated Optimization of Steel Trusses with Elasto-Plastic Behaviour Using a Neural Network-Genetic Algorithm Method

P. Grubits, M. Movahedi Rad

Department of Structural and Geotechnical Engineering, Széchenyi István University, Győr, Hungary

Keywords: optimization, steel trusses, elasto-plastic design, genetic algorithm, neural network

This study presents an automated framework for the optimization of steel trusses with elasto-plastic behaviour, targeting material-efficient designs while ensuring safety. Structural response is accurately captured through a custom-developed code that performs geometrically and materially nonlinear finite element analysis, within which the complementary strain energy of residual forces is evaluated and employed as a control metric to limit plasticity. This approach enables precise regulation of inelastic behaviour and, when required, ensures that the structure remains entirely within the elastic range, supported by the proposed computational technique and mathematical formulation. To enhance convergence and solution quality, a neural network is integrated into the genetic algorithm, enabling intelligent learning from data generated during the population-based optimization process. The effectiveness of the hybrid method is validated through benchmark numerical examples, demonstrating that the neural network-assisted genetic algorithm outperforms conventional implementations by achieving superior solutions in fewer generations, with reduced material consumption and minimized plastic deformation under predefined constraints. These results highlight the potential of automated hybrid optimization strategies and confirm the effectiveness of elasto-plastic design control in steel truss structures.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 44, 2024.

Paper 44

Symmetry Measure of Truss Structures Based on Group Representation Theory

M. Módis, F. Kovács

Department of Structural Mechanics, Budapest University of Technology and Economics, Hungary

Keywords: symmetric truss structures, descent of symmetry, symmetry measure, group representation theory

Our research addresses nearly symmetric 2D and 3D bar-and-joint structures whose symmetry is broken either by changes in their geometry (i.e., in the position vectors of their nodes) or in their cross-sectional properties (i.e., in the normal stiffness of their bars). Group representation theory can be applied to construct change-of-basis matrices that transform the coordinates of a natural basis (e.g., Cartesian) into a symmetry-adapted one. It is well known that the stiffness matrix of a symmetric structure, when expressed in a symmetry-adapted coordinate system, has a block-diagonal form. Consequently, symmetry-breaking disturbances become conspicuous in this setting: the stiffness matrix of a structure with broken symmetry will contain non-zero elements outside the main diagonal blocks.

The aim of our research is to quantify the symmetry of nearly symmetric structures by examining the changes in those stiffness matrix entries that are originally (before the disturbance) zero, rather than treating symmetry as a simple "yes or no" property. Furthermore, we show that geometric and structural symmetry may differ: we present examples where the stiffness matrix is block-diagonal in the symmetry-adapted coordinate system (indicating perfect structural symmetry), even though geometric modifications were introduced that prevent the structure from being geometrically perfectly symmetric.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 45, 2024.

Paper 45

Reliability Assessment of SHM Strain Measurements in the Southern Danube Railway Bridge

A. I. Mansi, L. Dunai

Department of Structural Engineering, Faculty of Civil Engineering, Budapest University of Technology and Economics, Hungary

Keywords: railway bridge, Structural Health Monitoring (SHM), signal denoising, strain measurements evaluation

Steel bridges play a vital role in domestic and international transportation, serving as critical components of transportation infrastructure. Ageing and the increase in traffic demands make it susceptible to deterioration issues like fatigue. Therefore, ensuring their safety and longevity while minimizing the economic cost is essential for sustainable infrastructures. Structural Health Monitoring (SHM) is a powerful tool for achieving these goals by facilitating periodic and continuous measurement, enabling the assessment of bridge performance under service conditions.

The new Southern Danube Railway Bridge in Budapest is equipped with a SHM system that continuously measures the behaviour characteristics, indicating an early alarm for any critical issue. Therefore, measurement reliability is significant for precise structural performance. A comprehensive evaluation of SHM strain measurements of the Southern Danube Railway Bridge was achieved, focusing on data analysis considering the denoising process of raw strain data to remove the noises caused by uncertainties through measurement. Following this, the strain gauge consistency is studied by investigating the measurements from strain gauges placed on complete structural symmetry. Furthermore the structural behaviour is evaluated by the strain responses due to the passing of identical and various trains. Seasonal and annual comparisons are also included to investigate long-term trends and the effects of temperature and environmental changes on strain responses. The results provide insights into the reliability of strain measurements over time and highlight the importance of proper signal processing in SHM systems for accurate bridge performance evaluation.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 46, 2024.

Paper 46

Numerical Simulation of Shear Bond at Concrete Interfaces Using Element Deletion

V. Shafaie, M. Movahedi Rad

Széchenyi István University, Hungary

Keywords: shear bond, interface layer, element deletion, finite element, concrete overlay

Reliable prediction of shear bond capacity at the interface between a repair layer and an existing concrete substrate is critical for performance and durability considerations. Conventional finite-element interaction schemes (e.g., tie constraints or overly stiff interface layers) tend to overestimate load capacity and suppress realistic crack initiation and debonding. This work introduces a mechanistically consistent finite-element workflow in Abaqus that employs element deletion to simulate damage initiation, crack propagation and interface failure under shear-splitting loading. The interface is represented by a thin, sacrificial layer endowed with damage initiation and softening laws linked to measurable mechanical properties; once a critical displacement or energy criterion is reached, elements are removed, naturally releasing load paths and reproducing post-peak degradation. The model is calibrated and checked against shear-splitting tests and then used to study how repair-layer material parameters - represented through effective elastic and strength properties - govern load transfer, peak bond capacity and failure mode. Results show that the element-deletion strategy captures the onset of debonding, the evolution of the fracture process zone and the transition to complete separation with close agreement to experiments, while avoiding the artificial stiffness retention typical of tie-based models. Sensitivity studies highlight the roles of mesh density, damage evolution parameters and contact definitions; practical guidelines for mesh regularization and parameter selection are provided to maintain numerical robustness without sacrificing physical fidelity. Overall, the approach offers a computationally efficient and transparent framework for assessing the shear bond of concrete interfaces and for guiding mix design and surface preparation strategies to enhance bond performance.

Acknowledgement

The authors thank the support of the EKÖP-25-4-I-SZE-74 University Research Fellowship Program of the Ministry for Culture and Innovation, funded by the National Research, Development, and Innovation Fund.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 47, 2024.

Paper 47

The Influence of Testing Method on the Determination of the Angle of Shear Strength in Sands: A Comparison of In-Situ and Laboratory Data

C. Szabóová, E. Kučová

Slovak Technical University, Slovakia

Keywords: shear-box test, dynamic penetration, angle of shear strength, sand

The determination of soil mechanical properties is a crucial step for the safe and economical design of geotechnical structures such as foundations, retaining walls and slope stability analyses. In geotechnical practice, these parameters are determined using two fundamental approaches: laboratory tests on collected samples and in-situ tests conducted directly in the natural soil conditions. This paper investigates and analyzes the mechanical properties of sandy soils, comparing the results obtained from both approaches. The objective of this research was to interpret the differences in the values of shear strength parameters that arise from different testing methodologies. For the experimental part, samples of sandy soil were used from a defined locality. Standard direct shear tests were performed in laboratory conditions in accordance with the respective standards. These results were subsequently compared with data obtained from in-situ tests, primarily the Dynamic Penetration Test, where the angle of shear strength is derived using empirical correlations. The results of the analysis showed systematic discrepancies between the two methods. The angle of shear strength determined from in-situ tests exhibited higher values compared to those obtained in the laboratory. This difference is attributed to the disturbance of the natural structure and stress state of the soil during sampling and sample preparation for laboratory testing, which is particularly problematic for cohesionless soils such as sands. The study confirms that for designs on sandy soils, in-situ tests often provide more representative data of the actual soil behavior in the soil mass. The results of laboratory tests need to be interpreted with consideration for potential distortion caused by sample disturbance. This work contributes to a deeper understanding of the limitations of individual testing methods and emphasizes the need for a comprehensive approach in geotechnical investigation to optimize design and ensure the reliability of structures.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 48, 2024.

Paper 48

Structural Design and Analysis of a Reinforced Concrete Bridge over the Mohansa River, Tanzania

S. B. Julius[1], **S. Elhadad**[1,2], **A. Salem**[1,3], **A. Fülöp**[1], **Z. Orbán**[1]

[1]*Structural Diagnostics and Analysis Research Group, Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Department of Architecture, Faculty of Engineering, Minia University, Egypt*
[3]*Civil Engineering Department, Faculty of Engineering, Minia University, Egypt*

Keywords: reinforced concrete, bridge design, hydrological analysis, geotechnical investigation, limit state design

This research presents the entire structural design of a reinforced concrete bridge across the Mohansa River and a valley in Michese, Tanzania, 12 kilometers from Dodoma. The research addresses a critical infrastructure gap by providing safe and reliable crossing to enhance the community's previously poor access to Dodoma city. The design methodology was grounded in a detailed site investigation. The TRRL East African Flood Model showed a peak flow of 75.99 m^3/sec, resulting in the bridge's height of 6.7 meters. Geotechnical investigations classified the soil as silty sandy gravel (GM), supporting a presumed allowable bearing capacity of 150 kN/m^2. Designed as a Class D feeder road for an average daily traffic of up to 400 vehicles, the structure accommodates HA and HB vehicular loading up to 1950 kN.

The final design specifies a three-span, reinforced concrete beam bridge, with each span measuring 16 meters. The structural integrity of all components was verified using a limit state philosophy in adherence with British Standards. Detailed structural drawings and bar bending schedules confirm the design's readiness for implementation. While the design is sound, the analysis indicated that ground bearing pressure at the abutment toe exceeded the presumed allowable capacity, requiring foundation optimization in the research's next phase. This study serves as a practical blueprint for applying civil engineering principles to solve real-world infrastructure challenges.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 49, 2024.

Paper 49

Hydraulic Modeling and Water Level Dynamics: A Case Study of Slňava Reservoir, Slovakia

D. Pavlov, L. Čubanová

Department of Hydraulic Engineering, Faculty of Civil Engineering, Slovak University of Technology in Bratislava, Slovakia

Keywords: flood protection, calibration, Slňava reservoir, model

This study investigates hydrodynamic behavior in the Slňava Reservoir, on the Váh River in western Slovakia. A one-dimensional hydraulic model was developed in HEC-RAS to analyze water level variations under different flow scenarios using two topographic datasets from 1978 and 2014. The comparison reveals morphological and hydraulic changes affecting reservoir storage and flood conveyance capacity. Bridge flow capacity was evaluated under extreme flood conditions, including the 100-year event. The model was calibrated using historical rating curve. The results demonstrate how numerical modeling supports long-term reservoir management and flood risk assessment.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 50, 2024.

Paper 50

Flood Protection of the Municipality in the Little Carpathians

N. Bilčíková, M. Červeňanská

Faculty of Civil Engineering, STU in Bratislava, Slovakia

Keywords: flood protection, emergency spillway, detention reservoir, flood wave, transformation

This article assesses the flood situation in the municipality of Little Carpathians. The main aim is to protect the inhabitants from floods in the long term with the least possible impact on the ecosystem. The article focuses on the hydraulic analysis of water level development and the proposal of flood protection measures on two streams flowing into the municipality from the Little Carpathians - the Marianka stream and the Drmolez stream.

The solution consists of designing detention reservoirs on both streams, which, according to their parameters (height, volume), would transform the flood wave and ensure its safe passage through the municipality.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 51, 2024.

Paper 51

Experimental Investigations of Downstream Water Level Effect on the Discharge Capacity of the Central Weir at the Čunovo Water Structure

R. Tóth, J. Rumann, A. Rutzká

Slovak University of Technology, Slovakia

Keywords: weir, discharge capacity, hydraulic research

The central weir at the Čunovo Water Structure, part of the Gabčíkovo-Nagymaros Waterworks, regulates discharge to the old Danube riverbed and conveys flood flows. Over time, sedimentation and vegetation growth have degraded outflow conditions, reducing the weir's discharge capacity. To evaluate this influence, hydraulic experiments were conducted on a 1:75 physical model of the structure under downstream water levels ranging from 128 to 131 meters. The results demonstrated a substantial decrease in discharge capacity, from approximately 3900 m3/s to 1200 m3/s, confirming the pronounced impact of downstream conditions on the hydraulic performance of the central weir.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 52, 2024.

Paper 52

Tracking the Lifespan of Vortical Structures in Forced Isotropic Turbulent Flow

H. Ahmed[1,2], **W. Abdel Kareem**[3], **Y. Velísková**[1]

[1]*Institute of Hydrology, Slovak Academy of Sciences, Slovakia*
[2]*Faculty of Civil Engineering, Slovak University of Technology in Bratislava, Slovakia*
[3]*Faculty of Science, Suez University, Egypt*

Keywords: vortex dynamics, vortex tracking, energy cascade, forced isotropic turbulence, Q-criterion

Accurately tracking the lifespan and evolution of vortical structures in isotropic turbulent flow is crucial for understanding energy mechanisms and improving turbulence modeling. The interplay among vortices governs energy transfer across scales in the flow medium. Although isotropy ensures statistical homogeneity, external forcing introduces additional complexity, leading to continuous vortex formation, interaction, and localized dissipation.

This study investigates the temporal evolution and lifespan of vortical structures in forced homogeneous isotropic turbulence using mathematical and numerical modeling at resolutions of 32^3, 64^3, and 128^3. Using the Q-criterion, vortices are identified and tracked across successive time steps to examine their duration, deformation, and continuity. Two complementary approaches are employed: the first analyzes turbulence evolution, energy transfer, and high-interaction points; the second focuses on mid-stage turbulence at 128^3 resolution to elucidate morphological changes, lifespan variability, and their relation to energy redistribution.

Results show that higher resolutions significantly improve the ability to capture vortex deformation, splitting, and prolonged interactions. At lower resolutions, vortices merge rapidly, whereas at higher resolutions, complex dynamics and extended lifespans become evident. Notably, at 128^3 resolution, approximately 58.06% of individual vortices could no longer be tracked beyond one time step, reflecting intense interactions and continuous structural refinement within the turbulent field.

This study establishes a framework for tracking vortex lifespans across resolutions, emphasizing the need for high-resolution analysis to capture the transient yet fundamental nature of turbulent flows. The methodology and results can be applied to modeling water flow in natural streams, flow around obstacles, turbine flows, and other fluid flow systems where turbulence and vortex formation influence efficiency or may cause structural damage.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 53, 2024.

Paper 53

Shared Roads, Different Codes: How Do Cyclists Perceive Autonomous Vehicles?

A. Hammami, A. Borsos

University of Győr, Hungary

Keywords: cyclist, autonomous vehicle, market penetration rate, shared road, infrastructure, safety

The design of road infrastructure has a key role in cyclists' safety. One of the critical infrastructures for cyclists is the shared road (sharrows). Where drivers tend to hold negative attitudes and aggressive driving behaviours towards cyclists. Although the concept of sharing roads is common around the world, it is challenging for cyclists to coexist with motor vehicle drivers. Moreover, the evolution of automotive engineering and digital technology has paved the way for autonomous vehicles (AVs) to move beyond blueprints to real-world traffic. With studies suggesting safer roads with AVs, the perceived safety of shared roads accommodating AVs and cyclists is blurry. Given the long-expected shift to 100% automated vehicle traffic, the current study aims to investigate the impact of three AVs' market penetration rates (MPRs) on cyclists' perceptions on a shared road. The road section selected as the object of this study is a 200 m-long straight segment of Szövetség Street, with an advisory bicycle lane (shared road), in the city of Gyor, Hungary. Using a bicycle simulator, 50 volunteer cyclists assessed their subjective safety, comfort, stress, and collision risk under 0, 50, and 100% AV MPRs. Several cumulative link mixed models (CLMM) were estimated to capture the effect of MPRs on cyclists' perceptions. The analysis of trajectories for cyclists and AVs is currently in progress. Our preliminary findings show that AV MPR decreased the perceived level of safety and comfort and increased the perceived level of stress.

Acknowledgement

The research was supported by the European Union within the framework of the National Laboratory for Artificial Intelligence (RRF-2.3.1-21-2022-00004).

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 54, 2024.

Paper 54

Integrating Artificial Intelligence for Building Performance Enhancement: Thermal Comfort as a Key Optimization Parameter

S. Elhadad[1,2], **Z. Orbán**[1], **A. Fülöp**[1]

[1]*Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Faculty of Engineering, Minia University, Egypt*

Keywords: artificial intelligence, building performance, thermal comfort, optimization, HVAC Systems, sustainable architecture

This paper explores the integration of artificial intelligence (AI) technologies to optimize building performance, with a specific focus on thermal comfort as a critical parameter. As urban environments increasingly prioritize sustainability, the enhancement of building performance through intelligent systems becomes essential. By leveraging machine learning algorithms and data analytics, we can analyze various factors affecting thermal comfort, such as occupancy patterns, indoor climate variables, and building materials. This study presents methodologies for implementing AI-driven solutions that dynamically adjust HVAC systems, improving energy efficiency while maintaining occupant comfort. Results demonstrate that AI implementations can significantly reduce energy consumption and enhance user satisfaction in smart buildings. The findings underscore the importance of thermal comfort in the broader context of building performance optimization, promoting a holistic approach to sustainable architecture.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 55, 2024.

Paper 55

Geometric Refinement of Crowdsourced Maps to Support Early Engineering Designs

B. Gadó

Department of Civil Engineering, Institute of Smart Technology and Engineering, Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: GIS, VGI, OSM, geometric accuracy, IOU, affine transformation, raster database

Volunteered Geographic Information (VGI) maps, such as OpenStreetMap (OSM), have become an integral part of our daily lives and are increasingly gaining traction in engineering practice. Their popularity stems from their detailed content and quick updates, ensured by the self-cleansing mechanism of crowdsourced editing. However, for engineering applications, geometric accuracy is a critical factor, which is often uncertain in these spatial databases. The present research aims to assess the geometric reliability of such data and develop a refinement procedure that improves the map's geometric fidelity.

The methodology was based on a controlled experiment where university students, representing average OSM users, performed digitization tasks. The data they created was compared against the existing OSM dataset and the cadastral land register base map, following the protocol of the European Location Framework (ELF). It is demonstrable that the students adequately represent the average OSM user. To quantify the geometric agreement of buildings, the Intersection over Union (IOU) metric - a standard measure in object recognition - was employed, which effectively measures the overlap of two polygons.

An affine transformation model was developed to correct systematic errors. The model records the area-specific transformation parameters in a raster data structure, enabling the modeling of the spatial distribution of errors and the execution of local corrections. With appropriate correction procedures, crowdsourced maps can serve as a valuable data source in the early planning phases of engineering projects, successfully combining the flexibility of community data collection with the geometric accuracy required by professional standards.

Information Technology

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 56, 2024.

Paper 56

Measuring the Effectiveness of Simulated Data for Depth Map Generation

B. Sebők-Tornai[1,2], **G. Várady**[1], **L. Czúni**[2,3]

[1]*Department of Technical informatics, Faculty of Engineering and Information Technology, University of Pécs, Hungary*
[2]*Doctoral School of Information Science and Technology, Faculty of Information Technology, University of Pannonia, Hungary*
[3]*Department of Electrical Engineering and Information Systems, Faculty of Information Technology, University of Pannonia, Hungary*

Keywords: depth map, simulated data, four-camera system, Blender, computer vision

This paper investigates the merits and limitations of a four-camera system designed for cost-effective and robust spatial sensing. A critical challenge in developing such systems is the time-consuming process of collecting sufficient real-world training data.

To address this, we propose the following approach: enhancing or replacing real-world measurements with data generated in a parameterized virtual environment. We utilize Blender to create a highly controllable simulation where virtual cameras are configured to precisely match the parameters of their physical counterparts. This setup allows for the efficient generation of large, realistic datasets of calibrated image pairs and corresponding ground-truth depth maps.

The core of our study is a comparative analysis of a four-camera solution using both real and simulated image data. We demonstrate that this simulation strategy greatly facilitates data collection, producing volumes of realistic images that are suitable for both traditional and AI-based depth map generation processes. We specifically focus on validating the effectiveness of the synthetic data against physical measurements.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 57, 2024.

Paper 57

Towards Robust and Generalizable Video Anomaly Detection Via Data Balancing

M. I. D. Almurumudhe, O. Hornyák

Institute of Information Technology, University of Miskolc, Hungary

Keywords: Video Anomaly Detection (VAD), data imbalance, scalable systems, sampling strategies

Video anomaly detection (VAD) is a critical task in computer vision with applications ranging from public safety to intelligent monitoring systems. A persistent challenge in this field is the severe imbalance between abundant normal video data and scarce anomalous events, which are often diverse, weakly labeled and difficult to capture. This imbalance biases model training, leading to poor recall and limited generalization in real-world scenarios. To address this, the proposed research investigates data balancing techniques across multiple dimensions, including sampling strategies, loss function design and synthetic data generation. Approaches such as curriculum learning, hard-negative mining, focal and ranking-based losses, and counterfactual anomaly synthesis will be explored to enhance both learning efficiency and robustness. Furthermore, the study integrates balancing strategies with self-supervised and weakly supervised frameworks, enabling effective use of both labeled and unlabeled data. By systematically tackling the imbalance problem, this research aims to advance the development of scalable, interpretable, and deployment-ready video anomaly detection systems.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 58, 2024.

Paper 58

Mathematical Background of the Construction and Application of 3D Meshes for Wound Reconstruction

S. Molnár-Zékány

University of Miskolc, Hungary

Keywords: 3D scanning, decubitus, mesh

The result of three-dimensional scanning is a digital object that represents the scanned living or non-living subject in electronic form. In this study, the scanning was performed using the LiDAR technology, and the scanned object was a pressure ulcer. The principle of LiDAR (Light Detection and Ranging) technology is to emit laser beams that reflect off the surface of the object and return back to the sensor. The system measures the time elapsed between the emission and return. This expression is called as the Time Of Flight which is a physical measurement principle previously used in radar and sonar technologies, and calculates the distance of each point based on this value. High-resolution and accurate surface reconstruction are essential to obtain a reliable and realistic digital representation of the wound surface. The resulting digital representation is stored in the form of a point cloud, which is a dataset derived from laser scanning. From this point cloud, mathematical algorithms establish connections between points, resulting in what is known as a 3D mesh. This mesh represents the geometric structure of the object's surface. The mesh, which can be constructed for example in the form of triangular meshes, can be interpreted as a graph consisting of vertices, edges, and also faces. The points of the point cloud correspond to the vertices of the graph, while the connections between the points are represented by the edges. The mathematical background of generating a mesh involves various topological and optimization algorithms, and the mesh is typically generated using interpolation methods such as Delaunay triangulation or Poisson surface reconstruction. The mesh can approximate the real surface at different resolutions: lower-resolution meshes are simpler and less detailed, but require less storage and computational capacity, while higher-resolution meshes reproduce the real surface in a finer and more detailed manner. The appropriate resolution is determined by the specific task or problem to be solved.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 59, 2024.

Paper 59

Semantic Analysis of Unsequenced Variable Accesses

Á. Hárnási

Eötvös Lóránd University, Hungary

Keywords: static analysis, Clang Static Analyzer, sequence point

The order of expression evaluation is not specified for all expressions in the C and C++ languages. For some expressions, for example, function call expressions and some binary operators, the standard allows the compiler to choose the sequence of sub-expression evaluation in order to allow for better optimizations. When correct program behavior depends on this sequence, the portability of that program is reduced, as the compiled program may or may not behave as expected depending on build system configuration. This is especially important in open-source projects where the program may be compiled in a wide variety of environments and configurations. Finding potential program errors resulting from sequence errors is often not intuitive, especially when the source of the error spreads into multiple procedures. A program may work initially, and the error may only surface after a change in the compiler. In this study we describe a method that can detect sequencing errors using static techniques. The method is based on symbolic execution and is implemented using the Clang Static Analyzer framework in the LLVM project. During testing, several real program errors were detected in popular and widely-used open-source projects with a reasonable false- to true-positive ratio.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 60, 2024.

Paper 60

Detecting Tagged Union Incosistencies with the Clang Static Analyzer

G. Tóthvári, K. Umann, Z. Porkoláb

Department of Programming Languages and Compilers, Faculty of Informatics, ELTE Eötvös Loránd University, Hungary

Keywords: C, union, static analysis, symbolic execution, tagged union, sum type, type confusion

The unions in the C programming language share some similarities with structs and classes, but they differ in the sense that all of their data members start at the same memory address. In other words, a union stores a single value with multiple type alternatives. Unless the union is used for type punning, the value of the union should be read through the same type that it was written. Failing to do so is almost always a bug in C, and is always undefined behavior in C++. Since C unions by themselves do not remember which member was last written in them, programmers often create tagged unions types. These are types that have an enumeration variable next to a union, which keeps track of the active union member. Since the relationship between the enumeration variable and the union is only implicit at the source code level, tagged union mistakes usually do not cause errors or warnings during compilation or static analysis.

This paper proposes a new static analysis algorithm to detect C-style tagged union code smells using symbolic execution. Our method first discovers how the program maps the enum constants to the union fields for each tagged union type. We issue a warning when a mapping assigns more than one union field to a given enum constant. Our solution is specified with the non-standard nature of this programming idiom in mind to avoid flagging code patterns that theorically violates the tagged union pattern but is correct in practice. We created a prototype in the Clang Static Analyzer, which has enjoyed widespread industrial and academic use in the past 15 years. We measured and evaluated the capabilities of our prototype on large, open-source projects.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 61, 2024.

Paper 61

Distributed Static Analysis Using Bazel and CodeChecker

T. Fürész, K. Umann, Z. Porkoláb

Department of Programming Languages and Compilers, Faculty of Informatics, ELTE Eötvös Loránd University, Hungary

Keywords: static analysis, C, C++, bazel, codechecker, clang, clang static analyzer, clang-tidy, parallelism, build systems

A historic problem of build systems is supporting tools beyond compilers like refactoring tools and software analyzers. Static analysis in particular has grown in popularity with the rise in computing power since 2000s, and considering the notoriously unsafe nature of C-style languages, it is especially frequently researched. At the cost of high memory usage and long analysis times, symbolic execution can find some of the most deep rooted programming errors. With that said, on large projects this cost can be prohibitively high.

This paper considers solutions for reducing the runtime of symbolic execution of C/C++ projects. We consider CodeChecker which runs one such analysis on Bazel projects. While some techniques already exist for distribution of build jobs across remote agents, analysis jobs are rarely considered. We introduce a comprehensive set of rules written in Bazel's Starlark that offers the performance advantages of distributed analysis while preserving the practical convenience of analysis report management present in CodeChecker. We measured the effectiveness of this solution by executing analyses on large open-source projects and evaluated our results.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 62, 2024.

Paper 62

A Revision of Literature on Static Analysis Applicability

K. Umann, Z. Porkoláb

Department of Programming Languages and Compilers, Faculty of Informatics, ELTE Eötvös Loránd University, , Hungary

Keywords: static analysis, industrial applicability, survey, literature review, false positives, configurability, warning messages

In the context of software technologies and literature, the field of static analysis is ancient. If we consider that compilation errors and warnings themselves are a form of static analysis, one could claim with ease that this field is about as old computer theory itself. Even involved algorithms, like symbolic execution, specifically tailored to find programming errors were around since the 1970s, and have enjoyed widespread use in the industry with the increase of computing power since the early 2000s.

While academic papers on new exciting techniques in the field of static analysis praise the technology, reading actual user experience reports paint a different picture. Static analyzer tools are frequently described as emitting numerous false positive or irrelevant reports and having poor quality warning messages, among other things. Since the early 2010s, renewed interest have sparked the publication of several surveys with human participants.

This paper serves as a literature review on the user experience with static analysis. We discuss eight papers conducting surveys on tens, hundreds, or even thousands of participants all to learn how static analyzers are used, what are its pain points, how are they configured, among many other aspects. Our paper improves on a revent literature review with a formalized inclusion/exclusion criteria, having located additional papers, and includes a deeper analysis of research results.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 63, 2024.

Paper 63

Predictive Maintenance Report Generation Using Large Language Models

M. Kernács[1], **O. Hornyák**[2]

[1]*József Hatvany Doctoral School of Informatics, University of Miskolc, Hungary*
[2]*Department of Information Engineering, University of Miskolc, Hungary*

Keywords: predictive maintenance, LLM, report generation, explainable AI, multimodal data processing

The aim of this research is to develop an intelligent system that enhances the efficiency of predictive maintenance. The study examined data cleaning methods and improvements in structured maintenance log management to enable large language models (LLMs) to generate more accurate and reliable recommendations. The system integrates operating hours, manufacturer manuals, and experiential reports to provide equipment-specific maintenance suggestions. In addition, it checks the Bill of Materials (BOM), determines the required spare parts and quantities, monitors warehouse stock levels after maintenance, and automatically issues alerts when inventory drops below a predefined minimum, supporting both operational reliability and resource optimization.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 64, 2024.

Paper 64

Trustworthy Parallelization Recommendations through Multi-Layer Validation: Combining LLVM Static Analysis, AI Pattern Recognition and OpenMP Specification Compliance

T. Ngo Phu Hoang, P. Iványi

Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: LLM, LLVM, parallel computing, OpenMP

Modern software requires parallel execution for multi-core processors, yet identifying safe parallelization opportunities remains challenging. Existing tools provide either overly conservative static analysis or unreliable AI suggestions without verification. In the paper a hybrid framework combining LLVM compiler infrastructure with large language models is presented achieving 95% accuracy while reducing costs by 70%.

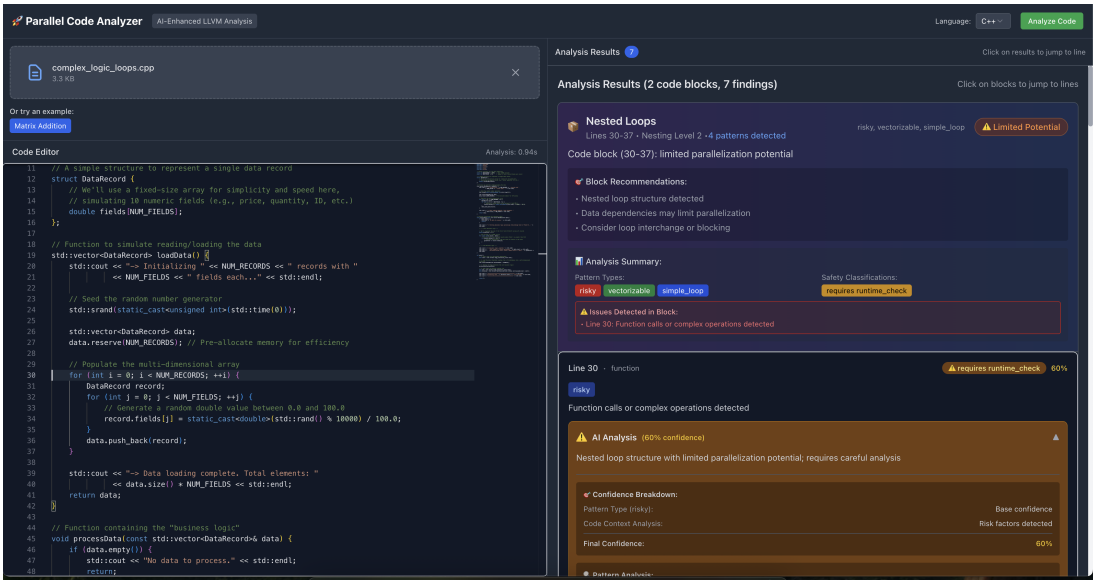
Our six-phase pipeline includes: (1) hotspot detection reducing overhead by 60%; (2) LLVM static analysis for dependencies and loop structures; (3) confidence filtering eliminating 50% of low-quality candidates; (4) AI pattern recognition with semantic caching (60% hit rate); (5) code block unification for consistent recommendations; and (6) line-level aggregation consolidating duplicates.

Critically, every suggestion is validated against the official OpenMP Examples repository (1,057+ patterns), providing ”Verified” (+30% confidence), ”Similar” (+15%), or ”Non-compliant” classifications. This ensures recommendations are specification-backed, not speculative.

Our code block analysis solves a key limitation: previous tools analyzed lines independently, producing contradictory recommendations within the same loop. By grouping related structures and applying unified safety analysis, the propesed system eliminates these inconsistencies.

Evaluation shows sub-second analysis (0.90s average), 95% accuracy versus expert analysis, 98% precision for safe parallelization and zero unsafe recommendations. The system provides transparent confidence scoring with full provenance tracking.

This work demonstrates that trustworthy automated parallelization requires intelligent synthesis of compiler infrastructure, AI, and specification validation, enabling safer parallel development with actionable, compliant recommendations.


Parallel Code Analyzer
AI-Enhanced LLVM Analysis
Language: C++
Analyze Code
complex_logic_loops.cpp
3.3 KB
Or try an example:
Matrix Addition
Code Editor
Analysis: 0.94s
// A simple structure to represent a single data record
struct DataRecord {
// We'll use a fixed-size array for simplicity and speed here,
// simulating 10 numeric fields (e.g., price, quantity, ID, etc.)
double fields[NUM_FIELDS];
};
// Function to simulate reading/loading the data
std::vector<DataRecord> loadData() {
std::cout << "-> Initializing " << NUM_RECORDS << " records with "
<< NUM_FIELDS << " fields each..." << std::endl;
// Seed the random number generator
std::srand(static_cast<unsigned int>(std::time(0)));
std::vector<DataRecord> data;
data.reserve(NUM_RECORDS); // Pre-allocate memory for efficiency
// Populate the multi-dimensional array
for (int i = 0; i < NUM_RECORDS; ++i) {
DataRecord record;
for (int j = 0; j < NUM_FIELDS; ++j) {
// Generate a random double value between 0.0 and 100.0
record.fields[j] = static_cast<double>(std::rand() % 10000) / 100.0;
}
data.push_back(record);
}
std::cout << "-> Data loading complete. Total elements: "
<< data.size() * NUM_FIELDS << std::endl;
return data;
}
// Function containing the "business logic"
void processData(const std::vector<DataRecord>& data) {
if (data.empty()) {
std::cout << "No data to process." << std::endl;
return;
Analysis Results
7
Click on results to jump to line
Analysis Results (2 code blocks, 7 findings)
Click on blocks to jump to lines
Nested Loops
Lines 30-37 • Nesting Level 2 •4 patterns detected
risky, vectorizable, simple_loop
Limited Potential
Code block (30-37): limited parallelization potential
Block Recommendations:
• Nested loop structure detected
• Data dependencies may limit parallelization
• Consider loop interchange or blocking
Analysis Summary:
Pattern Types:
risky
vectorizable
simple_loop
Safety Classifications:
requires runtime_check
Issues Detected in Block:
• Line 30: Function calls or complex operations detected
Line 30 · function
requires runtime_check
60%
risky
Function calls or complex operations detected
AI Analysis
(60% confidence)
Nested loop structure with limited parallelization potential, requires careful analysis
Confidence Breakdown:
Pattern Type (risky):
Base confidence
Code Context Analysis:
Risk factors detected
Final Confidence:
60%

Mechanical Engineering

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 65, 2024.

Paper 65

Optimal Supply Temperature for Fan-Coil Heating Systems Considering Thermal Comfort

Z. Tamásik, G. Loch, L. Budulski, A. Ózdi, B. Cakó

Department of Building Services and Building Engineering, Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: fan-coil, thermal comfort, draft, supply water temperature

With the widespread adoption of heat pumps, it has become increasingly necessary to retrofit traditional heating systems designed for boilers with high supply temperatures in many buildings. Since heat pumps operate with low supply water temperatures to achieve high energy efficiency, existing radiator-based heat emitters often fail to provide the desired thermal comfort. Consequently, surface heating systems (such as floor, wall, or ceiling heating) or fan-assisted convectors - commonly known as fan coils-are being used as suitable alternatives.

This study focuses on determining the optimal supply temperature for fan-coil heating systems. The aim is to identify a temperature range that ensures adequate heat output while avoiding draft effects that could cause discomfort for occupants. During the research, laboratory measurements are carried out to record the fan coil's air velocity, temperature distribution, and indoor thermal comfort parameters under varying supply water temperatures and fan speeds. Preliminary results indicate that excessively low supply temperatures require higher airflows, which can lead to draft sensations, whereas higher supply temperatures tend to provide more favorable comfort conditions. The ultimate goal of the research is to define a supply water temperature range that is optimal for both comfort and energy efficiency in heat pump-based fan-coil heating systems.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 66, 2024.

Paper 66

Dynamic Comfort Mapping and PMV Estimation with Neural Networks and On-Site Measurements

A. Ózdi, B. Cakó, L. Budulski, G. Loch, Z. Tamásik

Department of Building Services and Building Engineering, Faculty of Engineering and Information Technology, University of Pécs, Hungary

Keywords: thermal comfort, PMV modeling, dynamic comfort mapping, thermal sensation-based control systems, on-site measurements, neural networks

Determining human thermal sensation is a complex task influenced by numerous environmental and individual factors. It holds significant importance in comfort research, as we spend a large portion of our lives in indoor environments. Traditional temperature-based regulation of indoor comfort spaces can be optimized through a thermal sensation-based control system, which is one of the aims of our current research. Such an approach can improve both user comfort and energy efficiency. Our research group has previously developed and patented a system called the "comfort map," which can visualize thermal comfort parameters at various spatial points using a limited number of real measurements. At present, the practical application of the comfort map is being tested in a real open-plan office environment. The ongoing research aims to make the map dynamic, considering that microclimate conditions can change rapidly. Furthermore, we aim to predict the PMV (Predicted Mean Vote) value-beyond basic comfort parameters—using a neural network and low-cost solutions, as PMV is the most widely applied complex thermal comfort index and the fundamental input for sensation-based control systems. The next phase of the research involves training the neural network with real measurement data and validating the system through questionnaire-based surveys. The ultimate goal of the development is to enable office workers to identify their optimal working environment, thereby enhancing overall productivity.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 67, 2024.

Paper 67

Investigation of the Compensating Effect of Terminal Heating Units near Cold Glazed Surfaces

G. Loch[1], L. Budulski[1], A. Ózdi[1], Z. Tamásik[1], Á. Borsos[2], B. Cakó[1]

[1]*Department of Building Services and Building Engineering, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[2]*Department of Interior, Applied and Creative Design, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: thermal comfort, glazed surface, thermal manikin

Among the building envelope structures enclosing our comfort spaces, glass surfaces are the coldest during the winter heating season. Even with modern glazing, the inner surface temperature of the glass can be as low as 14 C, which may cause thermal discomfort in its immediate vicinity. This adverse effect is usually compensated by increasing the room air temperature or by installing a terminal heating unit in front of the window.

At the Department of Building Services and Building Engineering of the University of Pécs, Faculty of Engineering and Information Technology, we investigate the compensating effect of terminal heating units in the thermal engineering laboratory. The experiments are carried out in a closed test chamber, where each surface can be individually heated or cooled. One wall of the chamber is cooled to simulate the cold surface of glazing. In front of this cooled wall, a radiator or a fan-coil unit is installed, and the measurements focus on how these terminal heating units influence the surface temperature distribution.

For both types of terminal heating units, we examine the effect of the heating water temperature on the simulated glass surface, while in the case of the fan-coil unit, the influence of fan speed control is also investigated. In addition to surface temperature measurements, a thermal manikin is used to assess how the combined effect of the cold surface and the terminal heating unit placed in front of it influences human thermal sensation.

Abstract book for the
21st Miklós Iványi International PhD & DLA Symposium
Péter IVÁNYI (Editor),
ISBN 978-963-626-505-2, Paper 68, 2024.

Paper 68

Application of Questionnaire-Based Methods to Support a Fuzzy Decision Tree Model of Comfort Perception

L. Budulski[1], **A. Ózdi**[1], **G. Loch**[1], **Z. Tamásik**[1], **B. Cakó**[1], **J. Gyergyák**[2]

[1]*Department of Building Services and Building Engineering, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

[2]*Department of Architecture and Urban Planning, Faculty of Engineering and Information Technology, University of Pécs, Hungary*

Keywords: thermal comfort, Fuzzy logic, questionnaire method, ergonomic evaluation, subjective assessment

A multi-criteria decision tree model based on Fuzzy logic was developed and validated to address the subjective and uncertain nature of human comfort perception. The model integrates the main comfort parameters - such as thermal sensation, air quality, noise, and lighting - within a hierarchical structure. During the study, a questionnaire was designed and applied based on the MSZ EN ISO 10551:2020 standard, "Ergonomics of the physical environment. Subjective judgement scales for assessing physical environments", but adapted to the specific needs of the research. The analysis of the subjective responses enables the validation and fine-tuning of the model parameters, thereby supporting decision-making processes in a reliable manner. This contributes to a more accurate and human-centered approach to the ergonomic evaluation of physical environments.

Author Index

Keyword Index

Pollack Press
Pécs, Hungary
mmxxv