

15<sup>th</sup> Miklós Iványi International

# PhD LA symposium

Hungary, Pécs 28-29 October 2019

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## ABSTRACTBOOK



UNIVERSITY OF PÉCS  
Faculty of Engineering and  
Information Technology

**Abstract book for the  
15th MIKLÓS IVÁNYI  
INTERNATIONAL  
PHD & DLA SYMPOSIUM**

**Abstract book for the  
15th MIKLÓS IVÁNYI  
INTERNATIONAL  
PHD & DLA SYMPOSIUM**

ARCHITECTURAL, ENGINEERING AND  
INFORMATION SCIENCES

*Edited by*  
**Prof. Dr. Péter IVÁNYI**

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University of Pécs**

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# Salute

The 15th 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 15th 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 15th 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 MEDVEGY Gabriella, DLA  
Dean  
Faculty of Engineering and Information Technology  
University of Pécs



# Foreword

The 15th 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, Ninth, Tenth Eleventh, Twelfth, Thirteenth and Fourteenth International PhD&DLA Symposia were organized in 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018 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

BORSOS, Ágnes	Hungary	KÓCZY László	Hungary
BRUGGI, Matteo	Italy	KOSEC, Gregor	Slovenia
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DEITERDING, Ralf	United Kingdom	KREJCI, Tomas	Czech Republic
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FOLIC, Radomir	Serbia	LUNGOCI, Carmen Mihaela	Romania
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GYERGYÁK, János	Hungary	MOLNÁR, Tamás	Hungary
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KATONA, Tamás	Hungary	TÍMÁR, András	Hungary
KÉSZ, Miklós	Hungary	TOPPING, Barry	United Kingdom
KISTELEGGDI, István	Hungary	VÁRADY Géza	Hungary

# Conference program

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## Day 1: Monday 28 Oct 2019

**08:00-16:00** Registration desk open

**09:00-09:10** Conference opening,

**09:10-10:00** Opening plenary lecture by Prof. Ralf DEITERDING, Lecture 1

**10:00-10:50** Plenary lecture by Prof. Barry H.V. TOPPING, Lecture 2

**10:50-11:00** Group photo

**11:00-13:00** Conference session

**13:00-14:00** Lunch - *admission by ticket*

**14:00-16:00** Conference session

**16:00-16:30** Coffee / Tea Break

**16:30-18:45** Conference session

**20:00-22:00** Conference dinner, Champagne House (Pezsgőház) - *admission by ticket*

## Day 2: Tuesday 29 Oct 2019

**08:00-11:00** Registration desk open

**08:30-10:30** Conference session

**10:30-11:00** Coffee / Tea Break

**11:00-13:00** Conference session

**13:00-14:00** Lunch - *admission by ticket*

# Conference program

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## Day 1, Monday

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13:00-14:00	Lunch			
14:00-16:00	Architecture 2 page 8	Civil Engineering 2 page 9	Informatics 2 page 10	
16:00-16:30	Coffee Break			
16:30-18:45	Architecture 3a page 11	Civil Engineering 3 page 12	Engineering 3 page 13	Architecture 3b page 14

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Time	Room 1	Room 2	Room 3
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11:00-13:00	Architecture 5 page 18	Civil Engineering 5 page 19	Informatics 5 page 20
13:00-14:00	Lunch		

## **Day 1: Monday, 28 Oct 2019: AM, Room A010**

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**09:00-10:50**

**Conference opening**

Professor P. Iványi  
University of Pécs

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

**Opening and plenary lecture**

**Lecture 1** Third generation computational fluid dynamics: examples of adaptive Cartesian simulations with the AMROC framework  
R. DEITERDING

**Lecture 2** Journal Publication: An Editor's Overview  
B.H.V. TOPPING

**10:50-11:00**

Group photo in front of the building

## **Day 1: Monday, 28 Oct 2019: AM, Room 1**

**11:00-13:00**

### **Architecture 1a**

Chaired by Prof. MEDVEGY and Prof. DEVETAKOVIĆ

**P-48** The heritage and landscape reconstruction of the Intercisa Castellum in Dunaújváros  
N. PINTÉR, J.G. SZIGONY

**P-47** Viewpoints of making heritage place inventory through the example of the Museum of Applied Arts  
K.L. SEIDL

**P-21** Identification and restoration of the traditional watermills in the Lipjan region  
B. JAGXHIU, H. ÇADRAKU

**P-20** The rehabilitation of the historic commercial center of the old city of Aleppo after war - the methodology of the Aga Khan Trust for culture  
S. IBRAHIM, T. MOLNÁR

**P-18** Protection and renewal of Chinese ancient villages based on sustainable background  
H. CAO, A.M. TAMÁS, G. SZTRANYÁK

**P-17** Research on the reuse of interior space in historic buildings - Pinghe Packing Factory exhibition area design in Wuhan Design Day and the 5th Design Biennale in 2019  
ZK. HUANG, G. ZOBOKI, W. XIONG

**P-12** Design and research on regeneration of historic block buildings based on the concept of symbiosis  
P. HAOWEI

**P-4** Renaissance of the ruins – Give modern functionality to architectural relics  
K. XUE, G. MEDVEGY, Z. YUFANG

**13:00-14:00: Lunch**

## **Day 1: Monday, 28 Oct 2019: AM, Room 2**

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**11:00-13:00**

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Chaired by Prof. JÁRMAI

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**P-64** Laser tracker performance verification with calibrated steel bar  
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**P-126** CFD analysis on a direct spring-loaded safety valve to determine flow forces  
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**P-130** Magnetic braking method development for dynamic applications  
L. KAZUP, A. VÁRADINÉ SZARKA

**P-112** Prediction and numerical simulation of the residual stresses in pipes with multi-pass welds  
M.H. ALHAFADHI, G. KRALLICS

**P-131** The examination and optimization of 3D printing (FDM) parameters  
D. TÓTH, M. TISZA, P.Z. KOVÁCS

**P-111** Theoretical and numerical comparison study of aluminum foam sandwich structures  
A. AL-FATLAWI, K. JÁRMAI, G. KOVÁCS

**13:00-14:00: Lunch**

## **Day 1: Monday, 28 Oct 2019: AM, Room 3**

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**11:00-13:00**

### **Electrical engineering 1**

Chaired by Prof. HELEREA and Dr. LUNGOCI

**P-128** Integrated cooling solution for concentrator photovoltaic cells  
G. RÓZSÁS, GY. BOGNÁR, G. TAKÁCS, B. PLESZ

**P-125** Tensor product transformation based modelling of induction machine  
Z. NÉMETH, M. KUCZMANN

**P-119** Electromagnetic interference emission simulation of a BLDC motor  
D. ERDŐSY, T. BODOLAI

**P-118** Optimization capabilities of DC/DC step down converter with CasADi  
M. CSIZMADIA, M. KUCZMANN

**P-110** Combined electro-thermal model of a PV system  
A.K. ABDULRAZZAQ, G. BOGNÁR, B. PLESZ

**P-109** Enhance thermal efficiency of parabolic trough collector using Tungsten / Syltherm 800 nanofluid  
O. AL-ORAN, F. LEZSOVITS

**P-108** Relationship between number of modern lamps and level of radiated and conducted noise emissions  
R. ISTÓK

**P-84** Testing output variables for sensitivity study of nonlinear vibration systems  
F. HAJDU, GY. MOLNÁRKA

**13:00-14:00: Lunch**

## **Day 1: Monday, 28 Oct 2019: AM, Room 4**

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**11:00-12:45**

### **Architecture 1b**

Chaired by DR. BORSOS

**P-30** Simulation-supported design of high-rise office building envelope in moderate climate  
B. NAILI, I. KISTELEGGI, I. HÁBER

**P-2** Simplification method for energy building simulation  
S. ELHADAD, B. BARANYAI, J. GYERGYÁK, I. KISTELEGGI

**P-14** Exploring the relationship between child obesity and green space in England  
Q.C. HE, P. BRINDLEY

**P-11** Design for communities and acceptance  
E.ZS. PANCSA, F. KISS

**P-9** The urban memory and the identity of place: the requalification of the ex-European city  
Biskra, Algeria  
H. BARBARA, T. MOLNÁR

**P-127** Case study of a BIM-based pool refurbishment project focusing on hydraulic engineering  
O. RÁK, P.M. MÁDER, J. ETLINGER, M. EÖRDÖGHNE MIKLÓS, M. ZAGORÁCZ

**P-35** Parametric design workshops — Teaching geometry, programming and architecture on an experience-based way  
R. SÁRKÖZI

**13:00-14:00: Lunch**

## **Day 1: Monday, 28 Oct 2019: PM, Room 1**

**14:00-16:00**

### **Architecture 2**

Chaired by Dr. ZOLTÁN

**P-13** Enlightenment from street art activities in urban public space  
H.H. HE, J. GYERGYÁK

**P-34** Research on the development of public art in Beijing subway public space  
C. REN

**P-37** Making of fluid public heritage space – Case study: the historical Al-Merjeh square in the city center of Damascus  
S. IBRAHIM, T. MOLNÁR

**P-45** Urban design meets health - battle against mosquitos, case study in Pécs  
J. GYERGYÁK, V. BARACSI

**P-1** Schrumpfende Stadt as a city in transition  
B. SROKA

**P-28** Safe zones as a precautionary architectural and urban solution for potential civilian displacement disasters  
S.M. MAITEH, E.SZ. ZOLTÁN

**P-8** The potential inherent in BIM-based urban models  
O. RÁK, N. BAKAI, Á. BORSOS, P. IVÁNYI

**P-36** Under the perspective of community autonomy: the study mode of the intervention of public art into local renewal  
S.S. LIU, S.Z. ZHANG

**16:00-16:30: Coffee break**

## **Day 1: Monday, 28 Oct 2019: PM, Room 2**

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**14:00-15:45**

### **Civil Engineering 2**

Chaired by Prof. SOLTÉSZ

- P-75** Application of waste management in the smart city  
G. RÓZSA, K. LUKÁCOVÁ, J. HRUDKA, M. ŠUTÚŠ, Š. STANKO, I. ŠKULTÉTYOVÁ
- P-71** Laboratory analysis of the surface runoff from an urbanized area  
I. MARKO, R. CSICSAIOVÁ, J. HRUDKA, I. ŠKULTÉTYOVÁ, Š. STANKO
- P-61** Predicting the effect of load variation in an individual wastewater treatment unit  
B. BÁBA, T. KARCHES
- P-62** The impact of hydropeaking on sediment transport  
D. BUCEK, P. ŠULEK, M. ORFÁNUS, P. DUŠICKA
- P-65** Present condition analysis of sewer network in urban catchments  
R. CSICSAIOVÁ, I. MARKO, J. HRUDKA, I. ŠKULTÉTYOVÁ, Š. STANKO
- P-67** Adaptive data parameterization of baseflow and flashflood models of an ungaged watershed  
G. ÁMON, K. BENE
- P-57** Estimation of capillary rise in unsaturated gypsums sand soils  
S. ALSAMIA, M.SH. MAHMOOD, A. AKHTARPOUR

**16:00-16:30: Coffee break**

## **Day 1: Monday, 28 Oct 2019: PM, Room 3**

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**14:00-16:00**

### **Informatics 2**

Chaired by Dr. ERCSEY

**P-104** Monocular method of depth estimation

G. VÁRADY, T. STORCZ, ZS. ERCSEY

**P-102** Stability and movement analysis with exoskeleton

P. MÜLLER, Á. SCHIFFER

**P-106** Numerical solution of elliptic and parabolic PDEs with the application of discrete operators on graphs

Z. VÍZVÁRI, M. KLINCSIK, Z. SÁRI, P. ODRY

**P-94** Obstacles of integer programming in shift scheduling

M.L. MOLNAR, B.A. KOVARI

**P-117** Supplier evaluation with artificial intelligence

C. SIPOS, J. MENYHÁRT

**P-114** Lower bound definition for working time in crew scheduling problem

A. TÓTH, M. KRÉSZ

**P-89** Search space reduction in the progressive algorithm for automated employee scheduling

B. PINTÉR, B.A. KŐVÁRI

**P-129** New fields and possibilities in strategic sourcing

CS. SIPOS

**16:00-16:30: Coffee break**

## **Day 1: Monday, 28 Oct 2019: PM, Room 1**

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**16:30-18:30**

### **Architecture 3a**

Chaired by Dr. BORSOS

**P-46** The lighting design and the visual comfort in therapeutic centers  
N. SADOUD, E.SZ. ZOLTÁN

**P-29** People with dementia as active participants in researches related to built environment  
F. MARX, D. RÉTFALVI

**P-41** A feeling of awareness – site, history and human  
Q. ZHANG, A. HUTTER

**P-32** Adaptive reuse – methods and difficulties in practice  
T. RÁCZ

**P-6** Categories and characteristics of vernacular architecture in Chongqing  
S. YONGTING, A.M. TAMÁS, G. SZTRANYÁK

**P-15** Metamorphosis of water in architectural thinking  
G. HECKENAST, M. FERENCZ, A. KERTÉSZ

**P-40** Architectural visual design of contemporary era  
J. XIN, G. MEDVEGY

**P-39** Application research of modular design in modern residence  
W. MENG YANG

## **Day 1: Monday, 28 Oct 2019: PM, Room 2**

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**16:30-18:45**

### **Civil Engineering 3**

Chaired by Prof. FOLIC and Prof. BALAZ

**P-60** Investigation of the warping torsion of a press machine  
A. ERDŐS, K. JÁRMAI

**P-56** Composite steel and RPC testing  
P. MICHAŁEK

**P-53** Inverse determination of material properties of timber beams reinforced with CFRP using load-deflection data  
K. SAAD, A. LENGYEL

**P-51** Comparative study of moment resisting frames system and dual shear walls-frames system using ETABS 2016  
A. ABOU LTEAF, I. GULIAS

**P-55** Analysis and cross section development of cold-formed steel rectangular hollow flange beams  
N. EID, A.L. JOÓ

**P-72** Numerical analysis of composite slim-floor beams  
W. MEFLEH, N. KOVÁCS

**P-80** Analysis of shear contact between wrapped layout of fibre concrete and reinforced concrete  
M. VAVRUŠ, P. KOTEŠ

**P-81** Improving the failure behavior and reliability of indeterminate FRP-RC flexural elements using steel bars in critical sections  
A. SAKR, Z. ORBÁN

**P-82** Assessment of reinforced concrete slab of historical structures by the Yield-line method  
R. MAHROUSEH, Z. ORBÁN

## **Day 1: Monday, 28 Oct 2019: PM, Room 3**

**16:30-18:30**

### **Engineering 3**

Chaired by Prof. KOREN

**P-116** Comparison and evaluation of ADAS utilization at roundabouts  
H. CAO

**P-79** Definition of structural number of motorway pavement in Hungary  
I. SZENTPÉTERI

**P-68** Microscopic vehicle emission modelling using GAMLSS approach  
H. HAJMOHAMMADI, G. MARRA, B. HEYDECKER

**P-58** Review of using neural networks in traffic safety  
G. ALDABAIBEH, L. KISGYÖRGY

**P-91** Traffic load simulation for different sensor placements  
L. HAJDU, D. BALÁZS, M. KRÉSZ

**P-105** Image parameters of drone cameras  
G. VÁRADY, P. MÜLLER, Á. SCHIFFER, Z. SÁRI, B. TUKORA, I. JANCSKÁRNÉ ANWEILER

**P-101** Alternative methods for controlling drones  
P. MÜLLER, Á. SCHIFFER, Z. SÁRI, B. TUKORA, I. JANCSKÁRNÉ ANWEILER,  
G. VÁRADY

**P-120** Identification and segmentation of geometric shapes from point clouds  
R. HONTI

## **Day 1: Monday, 28 Oct 2019: PM, Room 4**

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**16:30-18:00**

### **Architecture 3b**

Chaired by Prof. KISTELEGGDI

- P-33** Validation of a building environmental analysis tool based on real field measurements in a hot and dry climate region  
M. RAIS, A. BOUMERZOU
- P-49** Thermal analyses of tensile structure of the Expo Center in Pécs  
S. NAGY
- P-10** Optimal office building design method elaboration using the Energy Design Synthesis method  
D. ZETZ, I. KISTELEGGDI, ZS. ERCSEY
- P-16** Family house design optimisation by application of the energy design synthesis method  
K.R. HORVÁTH, I. KISTELEGGDI, ZS. ERCSEY, Z. KOVÁCS
- P-19** An overview of developing energy prototype in bottom-up construction shelters  
R. IBRAHIM, B. BARANYAI, T.J. KATONA
- P-25** Aerodynamic shaping of a passively ventilated industry facility  
A. KATONA, I. KISTELEGGDI

## **Day 2: Tuesday, 29 Oct 2019: AM, Room 1**

**08:30-10:30**

### **Architecture 4**

Chaired by Dr. GYERGYÁK

**P-5** The spatio-temporality of a public space by observing the behaviours of its users, case of Sidi Bou Said

O. BEN DHAOU

**P-24** Diving center in Gyékényes, Hungary

S. JURDIK, K. KOVÁCS-ANDOR

**P-26** Development of an area where nature and tourism meets: Tisza backwater visitor centre

L.A. GYÜRE, K. KOVÁCS-ANDOR

**P-27** Inspiration of the potential of atypical residential area - A practice design study at Roissy-pole

C. LU, T. ZHAO, H. HE, Á. BORSOS, J. GYERGYÁK

**P-31** University of Pécs Western campus – Medical School development

P. PAÁRI, J. GYERGYÁK, P. SEBESTYÉN

**P-38** Modernization imposed: SOM's practice in Asia – Case studies of Jakarta, Kuala Lumpur and Wuhan

K. TU, A. REITH, J. LIU

**P-44** Research on the planning strategy of cultural and creative industrial park with Northeast regional characteristics

L. ZHAO, A.T. KERTÉSZ

**P-42** Research on coastal landscape design of Mingzhu bay in Nansha, Guangzhou

Z.X. LIANG

**10:30-11:00: Coffee break**

## **Day 2: Tuesday, 29 Oct 2019: AM, Room 2**

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**08:30-10:30**

### **Civil and other engineering 4**

Chaired by Prof. KRUIS and Prof. JUTILA

**P-54** Seismic retrofit of steel frame structures  
M. ISMAIL

**P-83** Correlation between dynamic and cone penetration test  
V. JÓZSA

**P-52** Correlations between dynamic penetration test results and coarse-grained soils characteristics  
E. KUCOVÁ

**P-50** Investigation of the effect of formwork shape on packing density of aggregate  
K.A. KÁROLYFI, D. HARRACH, F. PAPP

**P-77** Phase-field modeling of glass fragmentation  
J. SCHMIDT

**P-113** Reaction kinetic examination of production of aromatic hydrocarbons via thermocatalytic cracking of biomass and polystyrene  
A. ZSEMBERI, Z.K. SIMÉNFALVI, Á.B. PALOTÁS

**P-122** Experimental study on Pool boiling heat transfer of MgO nanoparticles based water nanofluid from a typical horizontal heated tube  
M.S. KAMEL, F. LEZSOVITS

**P-121** Dynamic simulation control in a cryogenic distillation column  
V. KÁLLAI, G.L. SZEPESI, P. MIZSEY

**10:30-11:00: Coffee break**

## **Day 2: Tuesday, 29 Oct 2019: AM, Room 3**

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**08:30-10:00**

### **Informatics 4**

Chaired by Prof. TOPPING and Dr. KREJCI

**P-103** Design and implementation of a machine-learning based image classification system  
S. TAKÁCS, Z. SÁRI, I. JANCSEKÁRNÉ ANWEILER, G. VÁRADY, Á. SCHIFFER,  
B. TUKORA, P. MÜLLER

**P-97** Distributed machine learning using data parallelism on mobile platform  
M. SZABÓ

**P-95** Optimal office building layout generation with backtracking to support energy design  
synthesis  
P. NOVÁK, I. KISTELEGI, ZS. ERCSEY

**P-92** Improving optimization using adaptive algorithms  
L. KOTA, K. JÁRMAI

**P-88** Modelling of agent needs using artificial intelligence and Maslov's hierarchy of needs  
A. BALAN, K. JEDRASIAK, A. GALUSZKA, C. LUNGOCI, E. PROBIERZ

**P-85** AI based detection of gas hydrate formation in the field  
I. BÖLKENY, L. CZAP

**10:30-11:00: Coffee break**

## **Day 2: Tuesday, 29 Oct 2019: AM, Room 1**

**11:00-13:00**

### **Architecture 5**

Chaired by Dr. KONDOR

**P-59** Overview and analysis of the overheating effect in Sudanese modern buildings  
S.I.A. ALI, Z. SZALAY

**P-7** 'Car race' with buildings... 'cube house' refurbishment in Hungary - A new design approach in the framework of Solar Decathlon 19 competition  
M. ALI, I. KISTELEGI

**P-3** The North Printing House: An ecological architecture model of combining localization, traditionalization and modern technology  
G. QIANG, E.SZ. ZOLTÁN, C. HUI

**P-43** Energy efficiency / new types of energy spaces  
Z. ZRENA, E. SZÜCS, G. GAZDAG, B. KÓSA, T. KONDOR

**P-23** Recycled national identity  
H. JUHÁSZ, T. KONDOR, B. KÓSA

**P-22** Renovation versus new construction - Innovative solutions in sustainable architecture: Solar Decathlon 2019  
J.G. SZIGONY, B. KÓSA, T. KONDOR

**P-115** Building services design focusing on comfort and energy  
B. CAKÓ, L. LENKOVICS, A. ÓZDI, M. EÖRDÖGHNE MIKLÓS

**P-123** The role of green roofs in the quality of the house  
L. LENKOVICS, B. CAKÓ, B. LENKOVICS, M. EÖRDÖGHNE MIKLÓS

**13:00-14:00: Lunch**

## **Day 2: Tuesday, 29 Oct 2019: AM, Room 2**

**11:00-13:00**

### **Civil engineering 5**

Chaired by Prof. SOLTÉSZ

**P-63** Analyzing the impact of intake structure modifications on the distribution of flow at a low pressure SHPP

L. BYTCANKOVA, J. RUMANN

**P-70** Hydrodynamic assessment of combined sewerage overflow chamber in Banská Bystrica  
M. ŠUTÚŠ, J. HRUDKA, G. RÓZSA, I. ŠKULTÉTYOVÁ, Š. STANKO

**P-73** Measures for flood discharge transformation on the Ondava River

J. MYDLA, A. ŠOLTÉSZ, M. ORFÁNUS

**P-74** Experimental assessment of effects of secondary stilling basin on energy dissipation at the Hricov Water Structure

M. PAVUCEK, J. RUMANN

**P-76** Assessment the water replenishment of the Drava floodplain oxbow

A. SALEM, J. DEZSŐ, M. EL-RAWY

**P-78** Hydraulic assessment of the impact of the closure structure realization on the Klátov river branch on the groundwater in the adjacent territory

A. ŠOLTÉSZ, D. BAROKOVÁ, M. CERVENANSKÁ, Z.D. SHENGA

**P-66** Climate change impact on runoff in Boca and Ipoltica River basins in Slovakia

G. FÖLDES, M.M. LABAT, S. KOHNOVÁ, K. HLAVCOVÁ

**P-124** The efficiency of different types of granular activated carbon in pesticide removal

M. MARTON, J. ILAVSKÝ, D. BARLOKOVÁ

**13:00-14:00: Lunch**

## **Day 2: Tuesday, 29 Oct 2019: AM, Room 3**

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**11:00-13:00**

### **Informatics 5**

Chaired by Dr. SÁRI and Dr. VÁRADY

**P-90** Application of software defined networks in vehicular ad-hoc networks  
S.I. BOUCETTA, Z.C. JOHANYÁK

**P-87** Extending P4 language with asynchronous compression  
A. GERELTSETSEG, M. TEJFEL

**P-99** The first step to axiom-based property verification of P4 programs  
G. TÓTH, M. TEJFEL

**P-96** New scheme for enhanced energy efficiency consumption based on LPWAN  
H. RAJAB, T. CINKLER

**P-100** Cryptography schemes for improving the security in large databases  
Y. YAN

**P-86** Keys and functional dependencies in incomplete databases with limited domains  
M. ALATTAR, A. SALI

**P-98** The relevance of preprocessing approaches in DTW based online signature verification  
C.L. SZÜCS, B. KÖVÁRI

**P-93** Software development for managing the student attendance lists  
M. DANUT, C. LUNGOCI, E. HELEREA

**13:00-14:00: Lunch**

**Other engineering fields**



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## Paper 114

# Lower bound definition for working time in crew scheduling problem

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**Keywords:** scheduling

In crew scheduling problem there is a set of daily tasks which have to be grouped into shifts such that each shift can be performed by one employee keeping some given rules. This problem arises many fields of real life such as drivers, nurses or call center scheduling.

In the literature the evaluation of the optimization methods usually concentrate on the minimization of the number of shifts. This aspect is not realistic in an industrial environment since it results in overloaded shifts leading to extra cost for the companies by overtime payment. A better objective is to minimize the total working time of the shifts. In addition to the compulsory tasks, in crew scheduling a shift can contain many other activities which count as working time as well. Typical examples in driver scheduling are maintenance, passenger service, availability, etc.. The working time of the compulsory activities can not be reduced since they must be fulfilled in any schedule, i.e. driving the trips of the timetable in driver scheduling. Therefore these activities provide a lower bound for the total working time at any optimization algorithm.

In this study a method is presented for calculating the lower bound for the working time of a crew scheduling problem which limits the possible reduction of the working time and gives a reliable evaluation of the optimization methods.

## Acknowledgments

The first author is grateful for the support of the EU-funded Hungarian grant EFOP-3.6.2-16-2017-00015. The second author gratefully acknowledges the European Commission for funding the InnoRenew CoE project (Grant Agreement #739574) under the Horizon2020 Widespread-Teaming program and the Republic of Slovenia (Investment funding of the Republic of Slovenia and the European Union of the European regional Development Fund).

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