

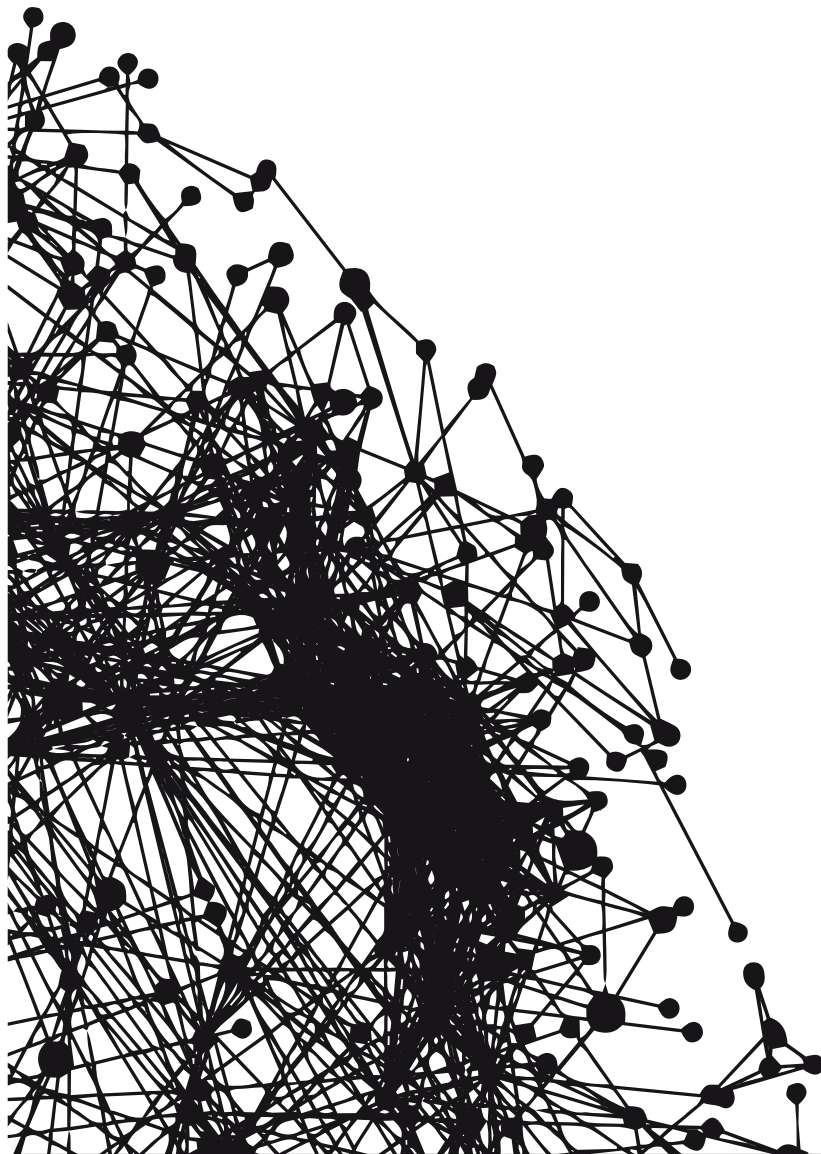
1ST INTERNATIONAL ACADEMIC CONFERENCE
PLACES AND TECHNOLOGIES 2014

BELGRADE, 3-4. APRIL 2014 | KEEPING UP WITH TECHNOLOGIES TO IMPROVE PLACES

editors:

Eva Vaništa Lazarević, Aleksandra Đukić,
Aleksandra Krstić - Furundžić, Milena Vukmirović

conference proceedings



ISBN 978-86-7924-114-6

www.placesandtechnologies.eu

Proceedings of INTERNATIONAL ACADEMIC
CONFERENCE ON PLACES AND
TECHNOLOGIES

APRIL 3-4, 2014, BELGRADE, SERBIA

PLACES AND TECHNOLOGIES 2014

PROCEEDINGS OF FIRST INTERNATIONAL ACADEMIC CONFERENCE ON PLACES AND TECHNOLOGIES

International Academic Conference on Places and Technologies, Places and Technologies 2014, will be the first conference organized by University of Belgrade – Faculty of Architecture, Professional association Urban Laboratory and University of Belgrade – Faculty of Philosophy.

Editors: Dr Eva Vaništa Lazarević, Dr Aleksandra Krstić-Furundžić, Dr Aleksandra Đukić and Dr Milena Vukmirović

For publisher: Dr Vladan Đokić

Publisher: University of Belgrade – Faculty of Architecture

Design: Stanislav Mirković

Place and year: Belgrade 2014

ISBN 978-86-7924-114-6

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

711.4.01(082)(0.034.2)
711.4:005.591.6(082)(0.034.2)

INTERNATIONAL Academic Conference on Places
and Technologies (1st ; 2014 ; Belgrade)

Places and Technologies 2014 [Elektronski
izvori] : keeping up with technologies to
improve places : conference proceedings : 1st
international academic conference, Belgrade,
3-4. April 2014 / [organized by University
of Belgrade - Faculty of Architecture,
Professional Association Urban Laboratory and
University of Belgrade - Faculty of
Philosophy] ; editors Eva Vaništa Lazarević
... [et al.]. - Belgrade : Faculty of
Architecture, 2014 (Belgrade : Faculty of
Architecture). - 1 USB fleš memorija ; 1 x 2
x 14 cm

Sistemska zahtevi: Nisu navedeni. - Nasl. sa
naslovnog ekrana. - Tiraž 150. -
Bibliografija uz svaki rad.

ISBN 978-86-7924-114-6

1. Vaništa Lazarević, Eva, 1961- [urednik]
2. Faculty of Architecture (Belgrade)
a) Градови - Мултидисциплинарни приступ -
Зборници b) Урбанистичко планирање -
Технолошки развој - Зборници

COBISS.SR-ID 206380812

ORGANIZERS



University of Belgrade
Faculty of Architecture

URBANLAB
PROFESSIONAL ASSOCIATION URBAN LABORATORY



ФИЛОЗОФСКИ
ФАКУЛТЕТ
1838

GENERAL SPONSOR



SPONSORS



Inženjerska komora Srbije

**INSTITUT
FRANÇAIS**
SERBIE



Gradska opština Savski Venac

Arhi.pro

PHILIPS



Foundation
Dokukino

DONATORS



Република Србија
МИНИСТАРСТВО ПРОСВЕТЕ,
НАУКЕ И ТЕХНОЛОШКОГ РАЗВОЈА



TONDACH
Krov za sva vremena!



SUPPORTERS



ISOCARP
Knowledge for better Cities



CAB
CENTAR ZA ARHITEKTURNU
ISTRAŽIVANJE



SIUP
Državni institut za
gradnju i opštinu



**SUPER
PROSTOR**
Portal za
arhitekturnu
kulturu i prostora

CONTENTS

PART I: URBANISM

Urban planning and technologies

OVERCOMING BARRIERS TO GROWTH

Stephen Platt 16

URBAN CHALLENGES OF ENERGY EFFICIENCY AND CONTEXT-SENSITIVE PLANNING APPROACHES IN BULGARIA

Elena Dimitrova 25

NEW URBAN PROTOCOLS FOR FRAGMENTED TERRITORIES _ THE EXAMPLE OF WESTERN THESSALONIKI

Styliani Rossikopoulou-Pappa, Valia Fragkia 33

A FEASIBILITY STUDY FOR A TECHNOLOGICAL PARK IN FALCONARA MARITTIMA AN, ITALY

Giovanni Sergi 41

SAVING URBAN PLANNING FROM ANOTHER UTOPIAN MODEL

Danijela Milojkić, Marija Maruna 48

THE IMPLICATIONS OF DIGITAL TECHNOLOGY ON THE PERCEPTION OF CENTRALITY

Mihai Alexandru, Cătălina Ioniță 56

TECHNOLOGY AND LANDSCAPE: REDUCE, REUSE AND RECYCLE THE MINING DROSSCAPES

Nicola Martinelli, Francesco Marocco, Alessandro Reina, Maristella Loi, Federica Greco 63

THE ILLEGAL SETTLEMENTS IN BELGRADE VS. TAMING CITY GROWTH: CASE STUDY OF BELGRADE

Biserka Mitrović, Miodrag Ralević, Branislav Antonić 71

IMPACT OF CLIMATE CHANGE IN URBAN PLANNING

Tamara Tošić 78

CONCEPT OF URBAN VILLAGE: THE APPLICATION OF THE CONCEPT AS A FOUNDATION FOR NEW TYPOLOGY OF URBAN VILLAGES

Branislav Antonić 85

RESILIENCE AND VULNERABILITY OF URBAN SYSTEMS. A METHODOLOGICAL PROPOSAL FOR SEISMIC RISK MITIGATION

Rigels Pirgu 94

Urban design and technologies

PUBLIC PLACES AND SPLIT DEVELOPMENT MODEL Višnja Kukoč	103
AGILE LANDSCAPES: REDESIGNING URBAN SPACE Anastasios Tellios, Despoina Zavraka	110
PLANNING AND DESIGNING SAFE AND SECURE OPEN PUBLIC SPACES IN SERBIA Svetlana Stanarević, Aleksandra Djukic	118
SPATIAL AND FUNCTIONAL TRANSFORMATION OF BUSINESS AREAS UNDER THE IMPACT OF INFORMATION TECHNOLOGIES – CASE STUDY OF NIŠ ADMINISTRATIVE DISTRICT Aleksandar Ristić, Petar Mitković	130
THE IMPACT OF NEW TECHNOLOGIES ON CITY ACUPUNCTURE METHODOLOGY AND INTERVENTIONS Kristina Careva, Rene Lisac	138
COMFORT OF OPEN PUBLIC SPACES: CASE STUDY NEW BELGRADE Aleksandra Djukic, Nevena Novakovic	145
005 PUBLIC ART IN BERLIN Biljana Arandjelovic	151
PROTECTION OF PERSON WHIT DISABILITIES: IMPLEMENTATION OF ACCESSIBILITY STANDARDS Dragana Vasiljevic Tomic, Radojko Obradović	160
VERTICAL PUBLIC SPACE Sorana Cornelia Radulescu, Roger Riewe	167
READY-AVAILABLE HYBRID METHODOLOGIES FOR CONTEMPORARY PUBLIC SPACE RESEARCH Milena Ivkovic, Berit Piepgras, Robin van Emden	175
RETAIL – NEW TECHNOLOGIES AND URBAN CENTRALITY Martin Brabant	181
TECHNOLOGY AND NEOLIBERAL URBAN PLACES Marija Cvjetković	191
NEURAL CITIES OR HOW CITIES TEACH US TO DESIGN THEM BETTER Angelica Stan	198
MORPHOLOGICAL AND TYPOLOGICAL CLASSIFICATION OF GREEN STREET FORMS: MLADEN STOJANOVIC STREET IN BANJA LUKA Tanja Trkulja	206

Urban regeneration and technology

PROPERTY ISSUES IN THE TURKISH URBAN REGENERATION PROJECTS

Mehmet Çete, Yunus Konbul 215

URBAN ENERGY AND URBAN REGENERATION STRATEGIES: EVALUATION OF IZMIR-UZUNDERE URBAN REGENERATION PROJECT

Yakup Egercioğlu, Çilem Türkmen 222

THE EMPTY URBAN SPACES AS AN OPPORTUNITY FOR THE CITY TO REINVENT ITSELF: THE CASE OF THE INDUSTRIAL TECHNOLOGICAL OBSOLETENESS

Cătălina Ioniță, Mihai Alexandru 230

ENHANCEMENT OF URBAN LIFE QUALITY IN URBAN REGENERATION PROJECTS: IZMIR-BAYRAKLI URBAN REGENERATION PROJECT

Yakup Egercioğlu, Tuğçe Ertan 238

THE INDUSTRIAL BUILDINGS WHICH USED IN SAUDI ARABIA AND SUSTAINABILITY

Wael Al-Buzz 246

AN OVERVIEW OF URBAN REGENERATION PROJECTS IN TURKEY

Yunus Konbul, Mehmet Çete 257

ART AND CULTURE AS INITIATORS OF ARCHITECTURAL AND URBAN TRANSFORMATION IN SAVAMALA

Ksenija Pantović, Iva Čukić, Jasna Kavran 265

Smart cities/regions and network protocols

SMART CITY GRAZ: FROM THE VISION TO THE ACTION

Carlos Varela Martín, Ernst Rainer, Hans Schnitzer 276

RESIDENTS INTERACTION WITH HOME RESOURCES

Cerasela Dinu, Constantin-Daniel Oancea 285

RENEWABLE AND DISTRIBUTED SOURCES WITHIN SMART ENERGY REGIONS

Jovan Todorovic 293

THE SMART CITY FOR THE FUTURE. HOW A SPATIALLY ENABLED AFFECTED BY THE URBAN POPULATION?

Shahryar Habibi 300

PERFORMANCE EVALUATION OF ROUTING PROTOCOLS FOR AD-HOC NETWORKS

Ledina Karteri, Valma Prifti 306

SMART CITIES AND CHALLENGES OF SUSTAINABILITY	
Rigels Pirgu	315
A FUZZY BASED CALL CONTROL SYSTEM IN MOBILE NETWORKS, CONSIDERING PRIORITY COMMUNICATIONS	
Valma Prifti, Ledina Karteri	323
Historical centers, Building heritage and Technologies	
ICT AND VGI TO PROMOTE MINOR HISTORIC CENTRES AND THEIR LANDSCAPE	
Pierangela Loconte, Francesco Rotondo	331
THE SUSTAINABILITY AND CULTURAL HERITAGE MANAGEMENT	
Christian Kersten Hofbauer, Elham Madadi Kandjani, Jean Marie Corneille Meuwissen	339
CONCEPTS OF FORMING OF URBAN SOLUTIONS IN HOUSING SETTLEMENTS IN BELGRADE BUILT IN PRECAST INDUSTRIALIZED SYSTEMS IN SECOND HALF OF XX CENTURY	
Dragana Mekanov	346
NEW ARCHITECTURE IN HISTORICAL CENTRES	
Alessandro Bruccoleri	355
INFORMATION AND COMMUNICATION TECHNOLOGIES TO IMPROVE THE KNOWLEDGE OF PLACES. THE ROME HISTORICAL CENTRE AS A CASE STUDY	
Francesca Geremia	363
CONTEMPORARY INTERVENTIONS IN HISTORIC PLACES _ THE EXAMPLE OF THESSALONIKI METRO	
Stavros Apotsos	372
Image and Identity of place	
THE IMAGE OF TRIFKOVIĆ SQUARE (NOVI SAD, SERBIA) THEN AND NOW	
Ivana Blagojević, Ksenija Hiel	380
IDENTITY OF NEW MEDIA SPACES	
Jelena Brajković, Lidija Đokić	388
THESSALONIKI: A MULTICULTURAL ARCHITECTURAL DESTINATION	
Niki Manou-Andreadis, Maria Milona	400
ELEMENTS OF IDENTITY AND UNUSED POTENTIALS OF CENTRAL ZONE IN NOVI SAD	
Milena Krklješ, Dijana Apostolović, Aleksandra Milinković	408

BELGRADE SKYLINE: CONTINUITY, PARADOXES & DESIRES Vladimir Milenković, Snežana Vesnić, Tatjana Stratimirović	416
CITY OF THE MIND - INVISIBLE IN THE MAP Jelena Stankovic, Milenko Stankovic	424
WHAT MAKES A PLACE? Saskia I. de Wit, Denise Piccinini	432
SUSTAINABILITY, IDENTITY AND ROLE OF TRADITIONAL MATERIALS Olivera Ilić Martinović, Mirjana Miletić	441
IDENTITY OF URBAN SPACES; ASSESSMENT AND EVALUATION Elham Madadi-Kandjani, Christian Kersten Hofbauer, Jean Marie Corneille Meuwissen	448
IMAGE OF SUSTAINABLE PLACES Vladimir Parežanin, Miloš Mihajlović	456
PRESERVATION OF IDENTITY OF SPACE WITHIN RAPID ECONOMIC AND TECHNOLOGICAL DEVELOPMENT OF TOURIST DESTINATIONS IN THE EXAMPLE OD JIJOCA DE JERICOACOARA IN BRAZIL Maja Momirov	469
 PART II: ARCHITECTURE AND TECHNOLOGIES	
Sustainability, Sustainable buidings and technologies	
SUSTAINABLE RETROFITTING OF EXISTING AND HISTORIC BUILDINGS Marina Traykova, Tanya Chardakova	477
OSMOTIC LANDSCAPES - RECOVERED IDENTITIES Venetia Tsakalidou, Anastasia Papadopoulou	485
DESIGN SCENARIOS FOR AN OFFICE BUILDING – ENERGY AND ENVIRONMENTAL ASPECTS Aleksandra Krstic-Furundzic, Tatjana Kosic	493
TECHNOLOGICAL AND ENVIRONMENTAL ASPECTS OF RAPID HOUSING CONSTRUCTION Nikola Macut, Bojana Stanković, Nataša Ćuković-Ignjatović	507
ENERGY ANALYSIS AND REFURBISHMENT STRATEGY FOR ZAGREB UNIVERSITY BUILDINGS: FORMER FACULTY OF TECHNOLOGY IN ZAGREB BY ALFRED ALBINI Stanka Ostojić, Zoran Veršić, Iva Muraj	515

SUSTAINABLE REUSE OF OLD STRATEGIC INFRASTRUCTURE CANAL DANUBE-TISA-DANUBE Mirjana Jočić, Nataša Kuburović	523
PLACE ATTACHMENT AS POTENTIAL FOR SUSTAINABLE LOCAL DEVELOPMENT IN SERBIA Anđelka Mirkov	533
LOW ENERGY BUILDINGS: CONCEPT OF ENERGY PERFORMANCE OPTIMIZATION OF SINGLE-FAMILY HOUSES Katarina Slavković	540
TECHNOLOGY AND PRODUCTIVE PROCESS: MINING REJECTIONS FROM WASTE TO SUSTAINABLE RESOURCE Vincenzo Paolo Bagnato, Giovanna Mangialardi, Silvana Milella, Michele Mundo	549
ADAPTATION OF AN INDUSTRIAL BUILDING INTO HIGHER EDUCATION INSTITUTION IN ACCORDANCE WITH IMPROVED ENERGY PERFORMANCE Branko Slavković, Komnen Žižić, Danilo Dragović	557
FUNCTION OF A DESOLATE SPACE Aleksandra Pešterac, Daniela Dimitrovska	565
ENVIRONMENT CERTIFICATION OF REHABILITATION DESIGN PROJECTS: PUT AND SHU BUILDINGS AS CASE STUDY Florian Nepravishhta, Gerta Veliu, Ramadan Alushaj	570
Green strategies and technologies	
GREEN URBAN STRATEGIES IN THESSALONIKI IN THE CONTEXT OF CRISIS Evangelia Athanassiou	580
GEOSCIENTIFIC EDUCATIVE CENTRE AS SUSTAINABLE COMMUNITIES BUILDING MODEL – POSITIVE COOPERATION EXAMPLE OF LIKA-SENJ COUNTY (CROATIA) AND UNA-SANA COUNTY (BIH) Ivan Brlić, Anita Bušljeta-Tonković, Katarina Milković	587
THE OCCUPANTS' PERSPECTIVE AS CATALYST FOR LESS ENERGY INTENSIVE BUILDINGS Lucia Martincigh, Marina Di Guida, Giovanni Perrucci	597
THE COLLECTIVE SELF ORGANIZED HOUSING EXPERIENCE IN ITALY Silvia Brunoro, Giacomo Bizzarri	605

APPLICATION OF ROOF GARDENS IN THE DEFINING IMAGE OF THE CITY	
Mirjana Sekulić, Bojana Stanković, Ljiljana Dosenović	613
STRATEGY FOR NATIONAL DEFINITION OF NEARLY ZERO ENERGY BUILDINGS	
Milica Jovanović Popović, Bojana Stanković, Jasna Kavran	621
ENERGY OPTIMIZATION OF THE BUILDING ENVELOPE OF THE REPRESENTATIVE SAMPLE OF THE EXISTING RESIDENTIAL BUILDING IN BANJA LUKA	
Darija Gajić, Aleksandra Krstić – Furundžić	629
BLUE GREEN DREAM AND DAYLIGHT	
Srdjan Stankovic, Cedo Maksimovic, Milenko Stankovic	637
POSSIBILITIES FOR ENERGY REHABILITATION OF TYPICAL SINGLE FAMILY HOUSE IN BELGRADE – CASE STUDY	
Bojana Stanković, Dušan Ignjatović, Nataša Ćuković-Ignjatović	646
BLUE-GREEN INTEGRATED MODELING SOLUTIONS IN URBAN PLANNING AND ARCHITECTURAL DESIGN	
Miloš Mirosavić, Ivana Mirosavić, Srđan Stanković, Čedo Maksimović, Ranko Božović	654
POTENTIALS AND LIMITATIONS FOR ENERGY REFURBISHMENT OF MULTI-FAMILY RESIDENTIAL BUILDINGS BUILT IN BELGRADE BEFORE THE WORLD WAR ONE	
Ljiljana Đukanović, Ana Radivojević, Aleksandar Rajčić	661
FROM BUILDING INFORMATION MODELS TO SIMPLIFIED GEOMETRIES FOR ENERGY PERFORMANCE SIMULATION	
Daniel Ladenhauf, René Berndt, Eva Eggeling, Torsten Ullrich, Kurt Battisti, Markus Gratzl-Michlmair	669
ENERGY CITY GRAZ - REININGHAUS: FIRST RESULTS FROM AN ENERGY SELF-SUFFICIENT QUARTER	
Heimo Staller, Ernst Rainer, Carlos Varela Martín	677
ENERGY EFFICIENCY AS ADVANCED TECHNOLOGY FOR A SOLUTION TO THE PROBLEM OF DEPOPULATION OF RURAL AREAS IN SERBIA	
Jovana Stanišić	684
THE ENERGY EFFICIENT CITY	
Ivan Dochev	692

Innovative materials, systems and technology

INVESTIGATION OF FLY ASH INFLUENCE ON CEMENT MORTARS PROPERTIES

Dragica Jevtić, Aleksandar Savić 701

INFLUENCE OF GLASS COMPONENT JOINTS ON THE STRUCTURAL GLASS FACADE DESIGN

Aleksandra Krstic-Furundzic, Tatjana Kosic, Jefto Terzovic 709

QUANTIFYING THE THERMAL BRIDGING EFFECT WITH REGARD TO THE FAÇADE'S CONFIGURATION

Katerina Tsikaloudaki, Theodore Theodosiou, Dimitris Aravantinos, Karolos Nicolaos Kontoleon, Dimitrios Bikas 720

THE INFLUENCE OF NEW TECHNOLOGIES ON MODERN CITY FACADES

Jasna Čikić Tovarović, Jelena Ivanović Šekularac, Nenad Šekularac 728

DYNAMIC APPEARANCE OF URBAN AND ARCHITECTURAL SURFACES

Tihana Hrastar, Tamara Marić, Bojana Bojanić 736

TOWARDS GENERATIVE CONVERGENCE IN DESIGN OF ARCHITECTURAL STRUCTURES

Jelena Milošević, Zoran Šobić, Miodrag Nestorović 744

APPLICATION OF WOOD AS AN ELEMENT OF FACADE CLADDING IN CONTEMPORARY ARCHITECTURE OF BELGRADE

Jelena Ivanović Šekularac, Jasna Čikić Tovarović, Nenad Šekularac 752

COMPARISON OF INSULATION APPLIED ON SURFACES OF MODEL PLACED IN THE AREA OF SKOPJE

Aleksandar Petrovski, Todorka Samardzioska, Ana Trombeva Gavriloska 758

APPLICATION AND EFFECTS OF PHASE CHANGE MATERIALS IN A MODERN ARCHITECTURAL AESTHETICS

Vladana Stanković, Goran Jovanović, Mirko Stanimirović 766

INTEGRATED DESIGN OF STRUCTURAL SYSTEMS

Aleksandra Nenadović 772

NEW COMPOSITE SLAB SYSTEM – LIGHTWEIGHT CONCRETE, STEEL SHEETING AND REINFORCEMENT

Zoran Šobić, Jelena Milošević, Miodrag Nestorović 780

MODERN METHODS OF STRENGTHENING MASONRY WALLS

Nenad Šekularac, Jasna Čikić Tovarović, Jelena Ivanović Šekularac 788

NEW PERSPECTIVES FOR FERROCEMENT

Ornela Lalaj, Yavuz Yardim, Salih Yilmaz 796

Cultural patterns, Architecture and technologies

SPATIAL AND SOCIAL ASPECTS OF THE ARSENAL TRANSFORMATION, MILITARY PORT IN TIVAT INTO NAUTICAL – TOURISM SETTLEMENT AND PORT „PORTO MONTENEGRO“ Goran Radović	805
DIGITAL FABRICATION IN THE FIELD OF ARCHITECTURE Roberto Vdović, Morana Pap	816
THE IMPACT OF SMART HOME TECHNOLOGIES ON ARCHITECTURAL DESIGN Goran Petrović, Marko Aleksendrić	822
BETWEEN THE PLACE AND NON-PLACE: ARCHITECTURE AND TERRITORY ON THE EXAMPLE OF SKOPJE Saša Tasić, Mitko Hadzi Pulja, Minas Bakalchev	830
INTEGRATED ARCHITECTURAL COMPLEXITY - FROM ABSTRACTION TO TECHNOLOGY AND MATERIALISATION Rada Čahtarević, Dženana Bijedić, Amra Taso	838
EVOLUTION DIGITIZED: ARCHITECTURE OF THE SUBLIME DREAM Mihailo Popović, Vladimir Milenković	846
MONOCHROMATIC IN THE ARCHITECTURAL COMPOSITION: WITH SPECIAL REFERENCE TO THE APPLICATION OF WHITE COLOUR Dragana Vasiljevic Tomic, Rifat Alihodzic, Dragana Mojsilovic	853
(RE)GENERATION & REFLECTIONS OF THE SCHOOL OF ARCHITECTURE – BANJALUKA IN THE CENTURY OF KNOWLEDGE AND SKILLS Milenko Stanković, Una Umićević	864
QUANTUM ARCHITECTURE, NON-PLACE AND ACCULTURATION Dubravko Aleksić	873
PLACES AND PRACTICES OF CONSUMPTION IN THE POST-SOCIALIST CONTEXT Dejana Nedučin, Dušan Ristić, Vladimir Kubet	880
INTERACTIONS BETWEEN LIGHT AND ARCHITECTURE: AN EXPERIMENT USING MODELS AND PHOTOGRAPHS Anita Stoilkov-Koneski	888
THE INTERPLAY OF MUSIC AND ARCHITECTURE: LAYERING OF SOUND AND SPACE Anja Kostanjšak, Morana Pap	895
CULTURAL PATTERNS AND SENSITIVITY TODAY: FROM THE PHILOSOPHY TO THE TECHNOLOGY IN ARCHITECTURAL DESIGN PROCESS	

Małgorzata Kądziela, Anna Sachse-Rynkowska	904
PART III: PLACES, TECHNOLOGIES AND RELATED FIELDS	
Big data, apps, social networks and microblogs in urban planning and design	
PLACE COMPETITIVENESS EXPRESSED THROUGH DIGITAL DATA. MEASURING THE PLACE ATTRACTIVENESS TRACKING THE GEOTAG DATA VISUALS	
Milena Vukmirovic, Eva Vanista Lazarevic	914
ROOM BOOK 2.0 – BRING BACK THE INFORMATION TO ITS PLACE	
Christoph Breser, Stefan Zedlacher	926
THE INTERCONNECTED OBJECT: ARE YOU AT HOME IN A NETWORK?	
Kalina Ntampiza, Polina Zioga	936
THE INTERACTION TIME IN A NETWORKED SOCIETY	
Danijel Baturina	944
GOOGLE EARTH AS A MICROWORLD	
Milena Zindović	962
TRANSPARENCY OF SCALE: GEOGRAPHICAL INFORMATION PROGRAM (GOOGLE EARTH) AND THE VIEW FROM BEYOND	
Pavle Stamenović, Dunja Predić, Davor Ereš	970
Geodesy and modern cartography	
ROBUST ESTIMATION APPLIED TO GEODETIC DATUM TRANSFORMATION USING A METAHEURISTIC ALGORITHM	
Mevlut Yetkin	979
THE STATE OF THE ART SURVEYING BY TECHNOLOGY OF THE TERRESTRIAL LASER SCANNING	
Marko Pejić, Branko Božić, Verica Erić, Jelena Pandžić	987
ROLE OF CARTOGRAPHY IN MAKING A “SMART CITY”: CASE STUDY OF INDIJA	
Dragutin Protić, Ivan Vučetić, Ivan Nestorov	995
MODERN CARTOGRAPHY IN PROJECT OF CENSUS	
Maja Kalinić, Dragoljub Sekulović	1002

Mobility and technologies

PERSONAL RAPID TRANSIT – A SUSTAINABLE URBAN TRANSPORT SYSTEM

Ljupko Šimunović, Luka Novačko, Mario Ćosić 1011

FLIGHTPATH TO AN ENVIRONMENTAL FRIENDLY AIR TRANSPORT

Ivana Čavka, Olja Čokorilo, Slobodan Gvozdenović 1020

PRESERVATION OF PLACE-IDENTITY THROUGH URBAN TRANSFORMATIONS BASED ON SUSTAINABLE FORMS OF TRANSPORT

Miloš Kopic 1029

BELGRADE RIVERSIDE TRAFIC INTERCHANGES

Ksenija Stevanović, Milena Stevanović 1037

SUSTAINABLE URBAN MOBILITY PLANS IN EUROPE

Davor Brčić, Ljupko Šimunović, Marko Slavulj 1045

URBAN DEVELOPMENT IN BELGRADE IN THE CONTEXT OF GLOBAL TRENDS: CHANCES OF ILLEGAL HOUSING INTEGRATION

Biserka Mitrović, Miodrag Ralević, Branislav Antonic 1051

RE-THINKING INFRASTRUCTURE PROJECT FOR THE METROPOLIS: LABORATORY GRANADA

Juan Luis Rivas Navarro, Belén Bravo Rodríguez 1059

Public participation, e-governing and tehcnology

COMMUNITY PARTICIPATION AND GREEN INFRASTRUCTURES: A DELIBERATIVE EVALUATION METHOD

Saverio Miccoli, Fabrizio Finucci, Rocco Murro 1067

RESULTS OF INTRODUCTION OF PARTICIPATORY TOOLS IN URBAN PLANNING IN SERBIA – 7 CASE STUDIES

Ratka Čolić, Harald Mueller 1075

WAYS TOWARDS A CITY OF NEW TECHNOLOGIES

Miodrag Ralevic, Tatjana Mrdjenovic, Natasa Krstic, Djemila Beganovic 1083

PARTICIPATION OF CITIZENS IN TOWN PLANNING PROCEDURES IN NEIGHBOURHOODS WITH FORMER REFUGEE AND DISPLACED POPULATION IN PRIJEDOR, BOSNIA AND HERZEGOVINA

Rada Latinović 1090

THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN A VIRTUAL ORGANIZATION

Jelena Lukić 1098

TOWARDS GENERATIVE CONVERGENCE IN DESIGN OF ARCHITECTURAL STRUCTURES

Jelena Milošević

PhD candidate, University of Belgrade Faculty of Architecture, Bulevar kralja Aleksandra 73/II, Belgrade, Serbia, e-mail: jelena.z.milosevic@gmail.com

Zoran Šobić

PhD candidate, University of Belgrade Faculty of Architecture, Bulevar kralja Aleksandra 73/II, Belgrade, Serbia, e-mail: zorn.sobic@gmail.com

Dr Miodrag Nestorović

University of Belgrade Faculty of Architecture, Bulevar kralja Aleksandra 73/II, Belgrade, Serbia, e-mail: enestorm@arh.bg.ac.rs

ABSTRACT

This paper reviews theme of generative convergence and its implications on the relation between architecture and its production tools. Beside assimilation of digital technologies, assigning of knowledge and appropriation of methods processes and procedures of other disciplines also demarcate current architectural discourse. Transfer of technologies, whereas technology does not infer just hardware but a mode of system thinking, involves effort for their integration in a manner that should correspond specific needs and conditions of architectural practice. The transposition of creative tools influences re-thinking of design process in the course of the logic of operation of applied tool enabling innovation and categorical transformations.

Focused on design of architectural structures an approach for performance-oriented design generation will be presented. Concept of design process as a production system enables application of different strategies, integration and convergence of diverse production systems in a single meta-system. In order to operate in productive way, these methods use CAD/CAM/CAE cross-platform and connect an object with the set created by automated generative system, moving emphasis from a single object to a system and its possibilities to produce variations. Goals of such considerations are efficient use of resources and optimization of design process.

Keywords: Performance-Oriented Design, Integrated Design, Generative Convergence, CAD/CAM/CAE, Architectural Structures.

INTRODUCTION - CONVERGENT DESIGN ENVIRONMENTS

The philosophy of integration is currently practiced in different domains. In an attempt to stay concurrent with fields of culture and production, architecture follows

that practice, competing their advanced environments by adapting new paradigms and performances. Assumption is that production tools, processes, mental and material creation would not fundamentally differ between diverse production categories. In addition, unification will represent a defining characteristic of the next generation of products and processes (Wroblewski, 2004). Faced with such reflections contemporary architectural theory and practice does not have a choice but to deal with the theme of generative convergence and its consequences.

Rapid evolution of technology and dramatic increases in complexity are changing the environment of architectural engineering. The challenges we face involve the convergence of design process driven by the proliferation of CAD/CAM/CAE cross-platform systems and automated production processes. These technologies enable experiments based on computational generation and digital fabrication of structures unconventional (i.e. non Euclidian) in its form, typology, and aesthetics, that were in past hard to conceive, represent, and produce. Innovation in structural forms are supported by the change in the creation process in which design, analysis, presentation, and production become part of collaborative process dependent exclusively upon digital technologies appointed by Kolarevic (2005) as *digital continuum*.

With the increase of computational capabilities, projects are converging toward a unique environment in which architecture and many types of knowledge-based expertise continuously crossover, exchange, analyze and produce information of all kinds. The expression of this condition is exemplified by the transformation of design studio into a design laboratory where designers experiment by acquiring terms and practicing discourses often borrowed from other disciplines, thus uniting art and science, mediating engineering and aesthetics. As the strict boundaries of design practice are increasingly questioned, broadened, and blurred, technology development and application, as well as incorporation of overlapping patterns, emerge as an essential vehicles for design exploration and assessment, opening possibilities for unanticipated outcomes. With that respect this paper will review the position, relevancy, and sustainability of the concept of generative convergence in design of architectural structures, its consequences, and in its implications on relation between architecture and its production tools.

GENERATIVE CONVERGENCE CONSTRUCT

Definition of convergence strongly varies from the context. While in technological context it could be defined as *tendency for different technological systems to evolve toward performing similar tasks* (Wikipedia, 2013), digital convergence can refer to *previously separate technologies that now share resources and interact with each other synergistically* (Wikipedia, 2014). The design industry is continually searching for a new ways to break down barriers and develop improved methods to build products. According to Wroblewski (2004) convergent design represents *methodology for optimizing the intersections between products, processes and content*. Though architecture could not easily model on the consumers industry that

unites design and production in one company (Stratil, 2010), advanced digital technologies as alluded by Kolarevic (2005) enabled re-emergence of the contemporary master-builders ... *fully involved in the making of a building, where making of a building means design, production and construction in an almost medieval fashion.*

Convergence culture - a flow of content across multiple media platforms and the cooperation between multiple media industries (Jenkins, 2006.), has affected the way we interact with news and information. *Mediamorphosis* (Fidler, 1997), or convergence of digital media, enabled by rise of digital communication in the late 20th century, resulted in current state in which we are surrounded by a multi-level convergent media world where all models of communication and information are continually reforming to adapt to the enduring demands of technologies *changing the way we create, consume, learn and interact with each other* (Fidler, 1997). Convergence in this instance is realized by interlinking of computing and other information technologies, media content and communication network that has arisen as the result of the evolution and popularization of the Internet as well as the activities, products and services that have emerged in the digital media space.

The integration of social movement in cyberspace and participatory culture could be detected in architectural design through groups like open source architecture, open source programming and openly-shared computation. Technology cluster represent another example of integration (i.e. cluster of 3D technologies that connects - 3D digitalization/scanning, measurement, shape, dimension and deformation control, 3D computational technologies, 3D fabrication technologies). This approaches are not standard for architectural practice and by determination to implement them, we change design process by applying tools which are slightly inappropriate, considering that initially they were not designated for the process of conventional architectural design. Transposition of creative tool effects re-thinking of design process through the logic of operation of new tool, enabling innovation and categorical transformations. Because it could be practiced in all disciplines, it could be said that there are no *convergence designers* (Wroblewski, 2004). Architectural designers who learn to program, marketing teams that employ anthropologists, and computer scientists who create music practice convergence design, by learning how through cross-disciplinary studies, diverse roles, and continual interest in the unknown.

In design of architectural structures generative convergence represents collaborative platform which efficiency is demonstrated through an integral multidisciplinary and performatively rational approach. While integration and multidisciplinary are being partly triggered by the specific character of the design field, performability, in this instance, is related to the inclusion of the structural performance consideration in the phase of design conception. Contrary to post-design optimization, application of generative from-finding techniques (i.e. qualitative and quantitative simulation and modelling), from the design outset, enables design exploration and evaluation, and facilitates rational performance based design concepts.

The challenge of convergence requires that we address complex designs in a new way, by embracing an idea of design chain that removes walls between design, analysis, construction. Convergence requires that we break down barriers between designer and generative design tools, between diverse medias for design communication, and between concept and its materialization. Theoretically, these obstacles could be overcome by using traditional methods. But those methods are prohibitively slow in the context of complex freeform structural design. In the future it will be virtually impossible to design highly integrated structures without removing the barriers within and in-between three identified domains, on the levels of - conception, communication, and construction. Within these three domain, we now confront three major areas of convergence.

Computer - Human/Designer Convergence

Development of information theories and related technologies, and accomplishments in the fields of Artificial intelligence and Cybernetics found its interpretation in design of architectural systems. Despite attempts to define autonomous design machines (Stiny and March, 1981) computational design relies on computer-human interaction for managing and implementing design generation. Application of computing technology in information processing is *modus operandi* following well-defined model expressed as an algorithm, or a protocol. Similarly, generative design represents productive, problem-solving discipline concentrated on a process flow defined by a recipe or a set of generative rules. The generative design arises in an algorithmic manner. The flow is based on self-organization and other predetermined autonomous processes. The instruction, or the program is defined by specified pattern (i.e. natural language, musical language, computer code, a mechanism, given composition). The generative process flows within the boundary conditions that can control but not determine the result (Stratil, 2010). Implications are architectural objects with the form that is no longer perceived as a fixed entity but a reactive system.

Generative design focuses on different methods that can simulate or interpret natural processes. Living nature has developed a specific method of synthesis controlled but not determined by physical information code of DNA and biochemical processes. The diversity and adaptability of organisms demonstrate the potential of these techniques to handle complex problems in design and to generate novelty and diversity from simple units (Stratil, 2010). In the context of the design of architectural structures derivation of optimal forms is realized by different evolutionary computational strategies (i.e. Evolutionary Algorithms, Genetic Algorithms, Evolutionary Topology Optimization, etc.) that have been merged into a research field labelled as computational morphogenesis. These techniques extend potentials of traditional form-finding tools implying possibly their new purposes within design process (Milošević, 2013).

Interface design that relies on computer-human interaction uses generative methods that offer a promising way of conceptualizing and working within a given context. Since they are implemented through an algorithm, the question arises

whether such processes still represent design. In traditional design the relationship between the designer and the object is commonly a direct one. Contrastingly, design by using generative methods arises autonomously. In this set, digital media applied for from production gain critical generative capacity, exceeding initial role of tool, in terms that they actively participate in creation and to some extent shape designers process of reflection. Furthermore, the definition and implementation of new, experimental, high-reliable, precise and efficient tools and application that accelerate design production represents an integral part of such design processes. Moreover, this kind of researches are not only restricted to the advanced use of commercial software but also to the development of customized subroutines and functions, transforming designer from software user into software developer and intensifying computer-human interaction.

Digital - Analog Convergence

Communication of the design ideas rarely relies on a single type of representation but rather on a network of geometric and non-geometric, digital and analog descriptions. In order to explore, evaluate and communicate their ideas practitioners in the field of design of architectural structures used diverse simulation and modelling techniques, from physical models (i.e. funicular models, soap film models, etc.), to virtual modelling techniques, since the 1970s (Dynamic Relaxation, Force Density Method, Finite Element Analysis). Technologies for structural performance based design have undergone a major transformation, from essentially static to interactive. Permanent progress of digital technologies (CAD/CAM/CEA, CNC, Rapid Prototyping, Optical measuring, Reverse Engineering, VR/AR), particularly from the middle of 1990s, opens up new opportunities for their use in the contexts of research and practice in the field of architectural engineering.

Production of form through the process of performance analysis and evaluations represents standard approach in the field of engineering but it is still not enough exploited in the field of architecture. Integration of design and structural analysis, that has remained an elusive goal due to mashing and data model transition that introduce discrepancies between design and analysis models thus breaking the design-analysis cycle, now can be grasp by Isometric approach (Hughes, 2005). By providing consistency between design and analysis models, this approach facilitates repeated analysis of parametric and free-form changes in geometry, shape and topology optimization, as well as effortless and simultaneous studies. Additionally, CAD/CAM and diverse rapid prototyping technologies offer different possibilities for fast production of 3D physical models (prototypes) in terms of accuracy, materialization quality and rate of development. These convergent growing techniques are used for production of models that could be used for aesthetical, spatial and structural evaluations, in all kind of functional tests that are sometimes required step preceding digital fabrication of real scale structure.

Material - Immaterial Convergence

Through the history of architecture necessity for efficiency was placed in-between dichotomies material/physical and immaterial/moral, expressed by Vitruvius trinity -

solidity (*firmitas*), utility (*utilitas*), beauty (*venustas*). Though architecture represents the connection between the shaping of material (*fabrica*) and rational conclusion (*ratiocination*), inconsistency in production process in the point of transition of design idea (immaterial) into a designed object (material) is identified as one of the key issues in complex freeform design. Constant development of digital fabrication techniques towards integration of material and immaterial aspect of architecture is increasingly liberating design process of restrictions imposed by construction demands.

Three dimensional computer models enabled formal exploration and analysis of digitally generated complex geometries and their dynamic transformations, in the way that was almost unimaginable before use of computers. Relation between phase of conception and production is redefines by establishing of direct link, introducing *file-to-factory* procedures and CNC production technologies. Realization of formally complex design solutions became less the question of feasibility, and more in the function of its computer generation and new tools necessary for digital production.

With the advent of rapid prototyping techniques (e.g. Dimitrov, 2006), it is now possible to fabricate complicated topologies directly from computer models using 3D printers to reproduce structural details point-by-point and layer-by-layer. Technique similar to 3D printing, referred as Counter Crafting, is being developed for the automated construction of whole buildings (Khoshnevis, 2004). This or similar type of fabrication techniques could be used in the future to construct unconventional architectural designs involving complex geometries generated by discussed design techniques.

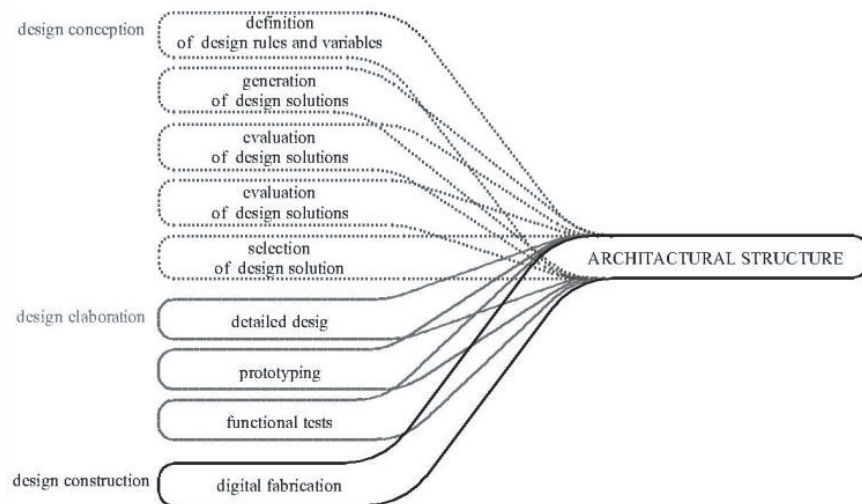


Figure 45: convergent generative design process

CONCLUSIONS

Design process is based on two-directional relation between designer and production tools. Assimilation of information technologies considerably changed that relation, opening opportunity for design exploration based on discovered potentials of computational tools. Transition of design process in automotive, simulative and interactive computational environments allowed widening of the potential architectural forms that should be leveraged to respond challenges posed by performance and aesthetics to create new formal and structural possibilities. This delocalization of the design activity across multi-dimensional grids of knowledge calls for a projective methods that would assure the assessment of its critical value, the nature of its performance, production and experiments.

Projects that embody convergence design principles blaze horizontal paths through organizations and build combinations and interactions of information. Because these projects span multiple disciplines, they rely on core design principles that are common to many fields of study. Designers are increasingly looking for cooperation to provide integrated solutions that will break down convergence barriers. Remarkable structures that advantage of design convergence are realized by production of the tools that designers need, tools that easily integrate with one another through the design chain and tackle convergence issue.

ACKNOWLEDGEMENT

Authors are supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Project No TR36008.

REFERENCES

- Dimitrov, Schreve, and de Beer. 2006. "Advances in Three Dimensional Printing - State of the Art and Future Perspectives". *Rapid Prototyping Journal*, 12(3): 136-47.
- Fidler. 1997. *Mediamorphosis: Understanding New Media*. Sage Publications, Inc.
- Grobman, Neuman. 2012. *Performativisam: Form and Performance in Digital Architecture*. New York: Routledge.
- Hughes, Cottrell, Bazilevs. 2005. "Isogeometric Analysis: CAD, Finite Elements, NURBS, Exact Geometry and Mesh Refinement". *Computer Method in Applied Mechanics and Engineering*, 194: 4136-4195.
- Jenkins. 2006. *Convergence Culture: Where Old and New Media Collide*. New York: New York UP, 2006. Print.
- Khoshnevis. 2004. "Automated Construction by Contour Crafting - Related Robotics and Information Technology". *Journal of Automation in Construction*, 13(1): 5-9.
- Kolarevic. 2005. *The Architecture in Digital Age*. New York and London: Spon Press.
- Milošević, Nestorović, Šobić. 2013. "Strukturalna morfogeneza: koncept generativne procedure za dizajn arhitektonske forme". *Tehnika*, 67 (4): 601-608.

Stiny, March. 1981. "Design Machines". *Environment and Planning B: Planning and Design*, 8 (3): 241-244.

Stratil. 2010. "Digital Master Builders - Evolutionary Formfinding in the Information Age". *International Journal of IASS*, 51(3): 232-240.

Wikipedia. 2013. "Technological convergence." Wikipedia - The Free Encyclopaedia. Last modified December 19, 2013. Accessed January 15, 2014.
http://www.wikipedia.org/wiki/Technological_convergence.

Wikipedia. 2014. "Digital Convergence." Wikipedia - The Free Encyclopaedia. Last modified February 6, 2014. Accessed February 10, 2014.
http://www.wikipedia.org/wiki/Digital_convergence.

Wroblewski. 2004. "Convergence Design" *Lukew Idertion+Design Blog*, August 16, 2004. Accessed January 15, 2014. <http://www.lukew.com/ff/entry.asp?88>