

The «Green Architecture» Definition Development in Modern Projecting and Building

Abstract

The article examines the “Green architecture” notion development as a new stage in architecture development as exemplified by the current trends in design and construction of the “Green architecture” projects.

Keywords: “Green architecture”, ecological problem, vertical gardening, arborsculpture, botanical architecture, “green” building, “living” construction, self-restoring construction, small architectural forms, landscape theater

1. Setting of the problem

The ecologic problem nowadays has become the most actual in every man’s field of life. Mankind has become aware of saving natural resources and environment problems. The need of searching for new ways for solving these problems is present. Only providing greenery areas are not enough for this, the architecture development with modern «Green architecture» projecting tendencies use is important too. Architecture should take into account ecologic reality of our time and be able to support this development in the same time. The «Green architecture» may become one of the ways for solving a set of ecological problems.

2. Recent researches analysis

A lot of scientists proceed with researching the interaction of architecture and nature in their works. Many modern architects and designers use methods of involving natural elements into architecture. Such people are: Renzo Piano, Friedensreich Hundertwasser, Andree Putman, Ralph Hancock, Jean-François Daures [2], Patrick Blank, Stanley Hart White and others. They have been using various ways of making vertical gardening and green roofs in their projects. However, there were people keen on and researching the idea of growing «living” constructions with fulfilling this into their projects: Axel Erlandson, Peter Cook, John Krubsack, Ferdinand Ludwig [3], Arthur Wiechula [4], Giuliano Mauri, Alessandro Rocca, Joachim Mitchell and others. The definition of the «Green architecture» has not yet achieved theoretical generalizing. Questions of methods and principles of the «Green architecture» are not fully reviewed in the scientific theoretic works yet.

At the National University «The Polytechnic of Lviv» at the architectural design chair the topics of landscape design and «Green architecture» of civilian objects and city spaces, landscape theaters are worked by: professor V. Proskuryakov, docent B. Goy, senior teacher U. Bogdanova, assistant

I. Gumennyk. This has been depicted in many students’ course and diploma works.

3. The article goal

To review main features of the «Green architecture» definition development in modern projecting and building with various examples of “green objects” projecting and building experience. To show that such architectural solutions make possible the creation of functionally-full and unique environment, interesting and attractive architectural object and in the same time they could enhance the ecology of surrounding environment.

4. Main material statement

The “Green architecture” is an art of forming space with means of natural landscape. The greenery is a main building material for such creation. With proper planning plants may become the material for most construction elements instead of the ones man build from metal and concrete.

The «Green architecture» integrates natural landscape into architecture with use of natural components for creating shapes, uniting architecture with nature. In such way the nature which is being pushed away from cities territories can be turned back into internal or external space of buildings and structures or create them with natural materials. [1]

Various parts of the World nowadays may have vertical gardening, «green» roofs, facades, balconies, terraces turned into gardens. The house gardening was used by many famous

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architects and decorators in their projects, such as Renzo Piano and Andree Putman, Hundertwasser, Ralph Hancock and others. Vertical gardening is the «living» walls of Stanley Hart White, Patrick Blank, Jean-Francois Daures achieve more and more popularity worldwide and being used both for exteriors and interiors of various houses and structures projects.

The “Green architecture” feature is the implementation of plants – the living material. That is why it is always in the state of “movement” – growing and developing, always changing during the seasons cycle, temperature, light... The plant architecture is a good vector for biovariety too. The plant walls, terraces, green roofs have a great effect on the biologic passages effect which should be created in the city. [2]

Also, the various techniques are present today in order to create different objects and structures, small architectural shapes using living plants: pooktre, pleaching, nivaki, «trees on wallpapers», arbosculture or the «living sculpture», bi-otecture, botanic architecture and many more. So one may form various archways, gazebos, summer living quarters, furniture, objects of any shape. These methods and approaches for creating various shapes using trees are directed to making special shape for trunk and branches. No complicated technology or tools are required, only the imagination, patience and time. (il. 1)

Many people were keen on the idea of growing buildings with living trees; for example, gothic architecture is known to be created with German shrub plexus.

In year 1926 Arthur Wiechula has published in Germany the «Developing Houses from Living Trees» book [4]. The book reviewed the technique of creating multi-storey houses, bridges, towers and other architecture objects using living trees. Maybe then, in progress of writing this book the definition of “arbosculture” (latin «arbour” – a tree) has been created.

His idea is very simple: why do one need to grow a tree, chop it down, saw into parts and then build a fence or a shed with wooden planks if one may make the same fence directly with the wood itself. This makes possible not only the labor economy – in such way one may save the tree, including all of it’s living effects and in the same time – achieve a self-renewing

structure. Wiechula thought that in such way one may build not only fences but sheds, supporting walls, bridges... (il. 2)

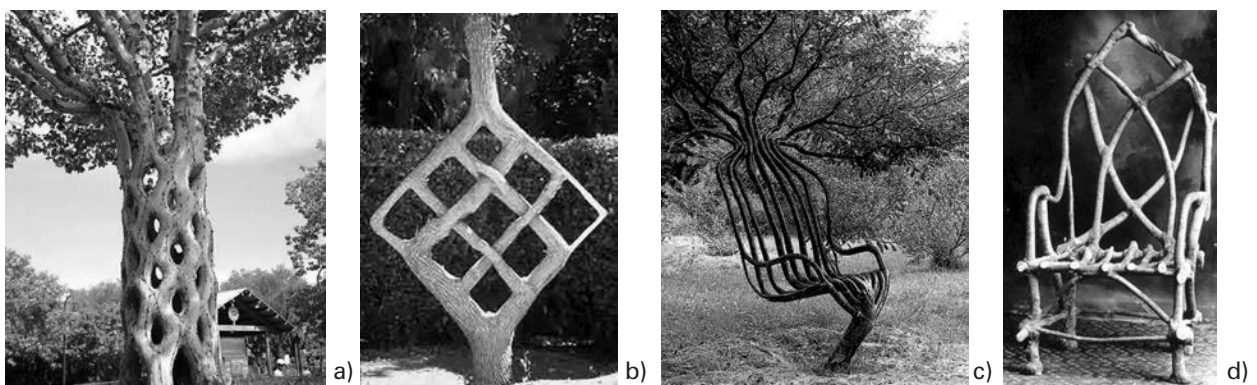
His work is rich with examples of possible buildings and offers (for example, to use popular trees which are capable to grow 2 meters high and 3 cm wide per year; to use trunk slashes for binding). But he could not try all his ideas practically. This action has been taken by the Neulohe company (Neulohe GmbH) in year 1930. It has detected some disadvantages and patented own way for connecting branches. This method is known with their name.

Since year 2004 the Modern architecture basics institute at Stuttgard university is working on the «building botanic». Their main idea is similar to Wiechula’s one. [5<http://buntarh.livejournal.com/35202.html>]

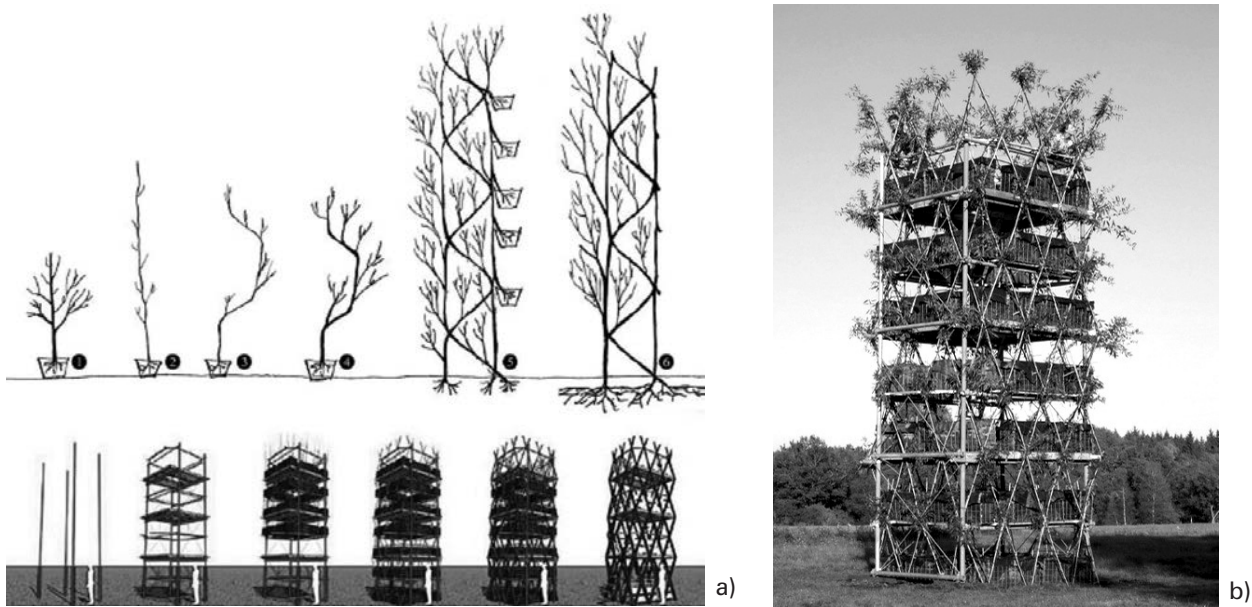
So according to historic descriptions and researches it is clear that wood may adapt to various outside loads and easily carry a role of bearing structural member without suffering any disadvantages or harm for itself.

Arthur Wiechula did not build a full-value house with living trees but anyway his ideas were not lost. Contemporary designers managed to grow a gazebo with pipal trees at the Okinawa island Bio-park in Japan. All of it’s construction parts are fully alive and continue to grow. Columns are made of properly connected young pagodas which have grown and completely binded together. [6<http://any-site.ru/publication/arborsculpture>]

But contemporary experimental “green building” has examples of multi-level structures too. Friedrich Ludwig’s doctoral dissertation (Modern architecture basics institute at Stuttgard university) is focused on building a three-level tower with living white pussy-willows (*Salix Alba*). It has nine meters height



il. 1 Shapes using trees [3]: a) «The basket tree» at the Axel Erlandson’s «Circus trees», California, USA; b) «Needle & Thread Tree» at the Axel Erlandson’s «Circus trees»; c) Tree Chair grown by Peter Cook, 1998; d) John Krubsack’s chair, Wisconsin, USA, 1919



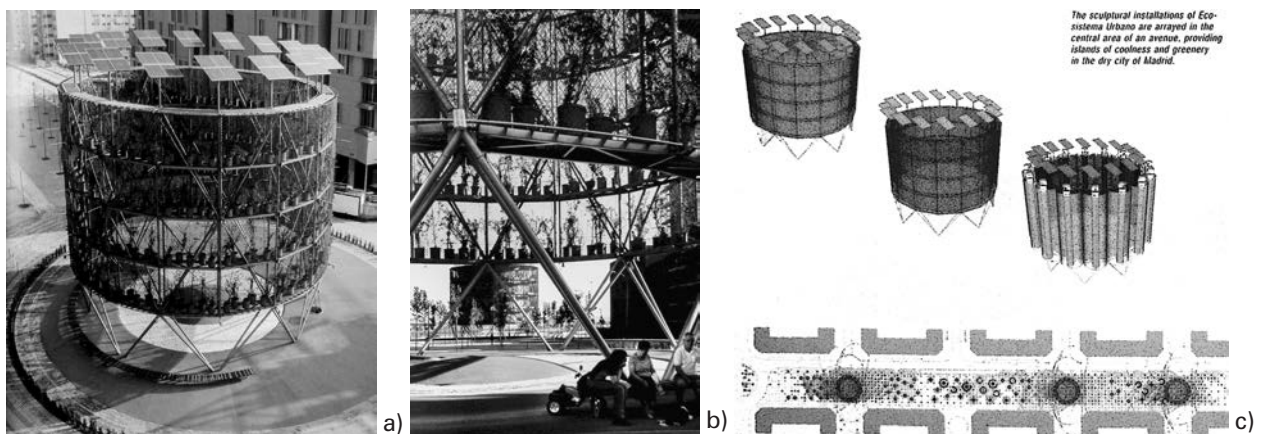
Pic. 2 Living tower [7<http://www.dezeen.com/2011/10/25/the-patient-gardener-by-visiondivision/>]: a) Baubotanik-Turm, b) The principle of building green tower

and about eight square meters of square. Currently the tower is made mostly of metal parts in order to support trees and direct their growth in needed direction.

The tower made of plants has already been built in cooperation with Cornelius Hackenbraucht. (Neue Kunst am Ried) (© Ferdinand Ludwig, University of Stuttgart) Plants grow together in natural way but scientists made them to follow the pattern developed by Ludwig and his colleagues. Botanic builders have realized their constructions using ancient knowledge and using traditional methods of binding trees together. Thereby scientists could develop a way to connect thin branches and stems of one kind into a single organism. The goal of this project is to create the all-sufficient eco-structure with individual plants connected into a single organism and create a stable farm. Temporary framework and contain-

ers will be removed at the point when the living structure will become strong enough to carry the weight of both steel platforms and working weight. Pussy-willows would develop further forming green walls and ground would have a strong developing root system as a solid basis for the whole structure. [8<http://www.dezeen.com/2011/10/25/the-patient-gardener-by-visiondivision/>] (il. 2)

Another example of a multi-level «green building» – the Ecoboulevard in Madrid. It was created by Ecosistema Urbano architects in year 2006. The architects said: «Proposition for Ecoboulevard in Vallecas city may be defined as an urban utilization operation. It requires



il. 3 The proposal for the Ecoboulevard of Vallecas, Ecosistema Urbano Arquitectos, Madrid, Spain, 2006 [9<http://www.dezeen.com/2011/10/25/the-patient-gardener-by-visiondivision/>]: a) Ecoboulevard of Vallecas; b) The round volume of pavilions house; c) The sculptural installations of Ecosistema Urbano are arrayed in the central area of an avenue, providing islands of coolness and greenery in the dry city of Madrid

erecting three social self-renewing «air tree-constructions» to be located in historically-formed city environment...

«Air-trees» are reinforced with photoelectric systems which are meant to be the «temporary prostheses». They will be removed with places left looking like forest meadows «Air trees» are located inside the space which should be filled with real mature trees for city space forming. The «air trees» contain a system that uses water vapor with power generated by the photovoltaic cells to create a space that is “8° to 10°C cooler than the rest of the street in summer.” [9http://www.dezeen.com/2011/10/25/the-patient-gardener-by-visiondivision/] (il. 3)

So learning the «Green architecture» experience and using it’s contemporary tendencies is actual and well-timed worldwide and in Ukraine. Historical architecture and city-building in Ukraine are used to exist in harmony with nature, there are large areas of greenery in the country proofing this. But modern trends of city intense building over parks and green areas make nature to slowly disappear from cities.

At the National University «The Polytechnic of Lviv» architectural design chair topics of civilian objects and city spaces “Green architecture” are also being worked. This has been depicted in many students course and diploma works which numerous times became winners of international architecture projects contests.

At the year 1999 at the National University “Polytechnic of Lviv” the diploma work on topic “Architecture-image and functional solution for terrace parks of the Pidgoretsk palace (with mobile landscape elements and architecture-object environment development)” has been fulfilled by U. Bogdanova and N. Vasylykiv under supervision of professor V. Proskuryakov. (il. 4)

The project’s main goal was to search for effective operative means of palace structure physical support and park complex environment. Also there was a proposition of developing various new functions which might be attractive for numerous visitors of the park complex.

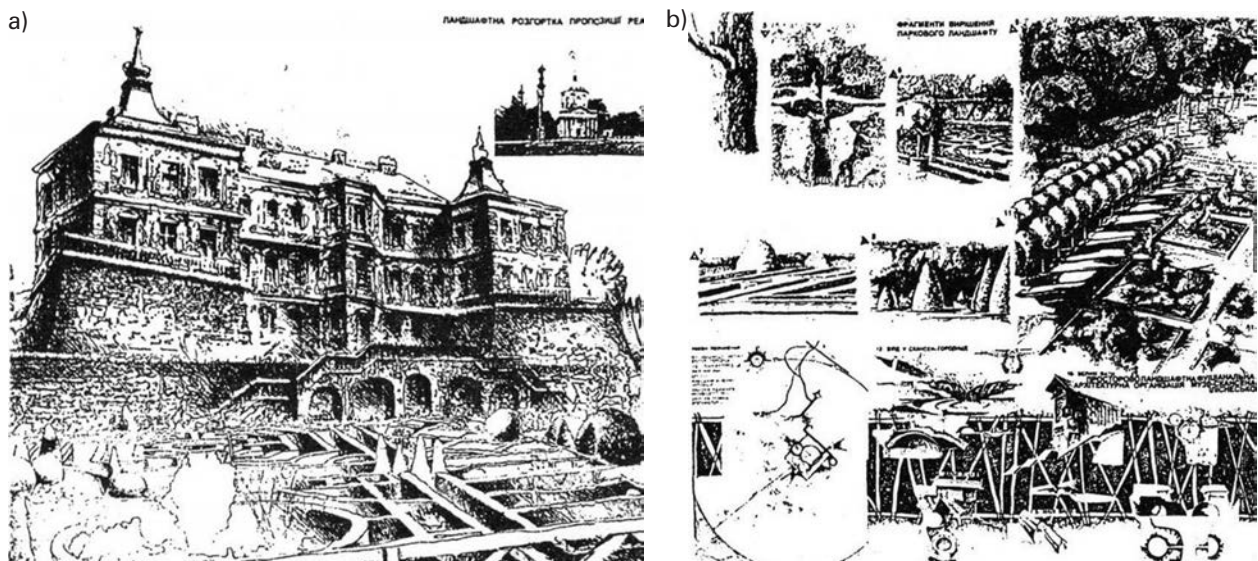
The project’s main architecture concept was defined as the mobility idea for the palace landscape, park space dynamics and possibility of fast transformation for it. Landscape is capable of harmonically forming mobile architecture-spatial

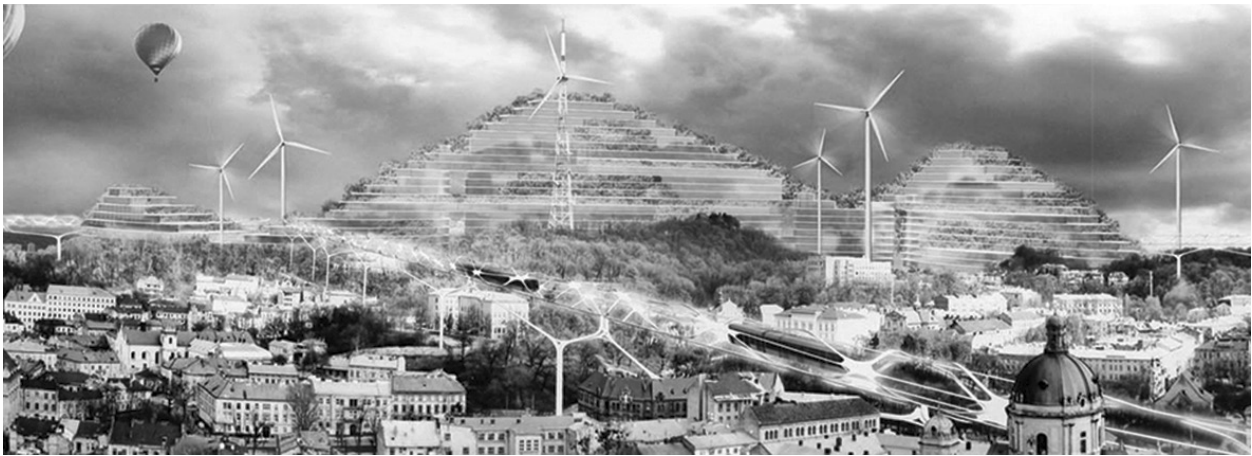
environment and in the same time is an element of it and all of the squares, rampants, bridges, balconies, terraces, couloirs, stages. All these elements form flexible spacial environment which is always able to evolve depending on function-typology needs. If the main action is the theater then park terraces may be used as backdrops, portals, avant- and rearstages, scenes. And the alleyways are theatrical passages, couloirs. [12] So this project managed to create with means of landscape nearly first in Ukraine architecture-spatial environment which meets the requirements of projecting contemporary “Green architecture».

Another diploma work deserves special attention – it is completed by student Oksana Sinkevych at the AED chair under supervision of professor V. Proskuryakov and docent B. V. Goy and is called «The concept of architectural environment post extensive development in Lviv city» (il. 5). Some ideas of «green architecture» were also realized in it, but on a way different urbanistic level.

This project offered to take a look at ancient Ukrainian Lviv city’s development potential in context of main futuristic ideas of XX-XXI centuries. In this way (according to tendency of city population decreasing) the project offers not to enlarge Lviv building spot and not to develop the polycentric idea (which has been declared way back in the Soviet city general plan and serves as a basis for the new general plan which has been approved in year 2010). But to make the developing a single general city center idea the highest priority one. Of course one should find new territories and areas for this. This project offers to use not only the resource of existing half-degraded housing in central part of the city and inefficient industrial areas, but the

il. 4 Architectural and landscape-image solution for terrace parks of the Pidgoretsk palace. Supervisor V. Proskuryakov, diploma of U. Bogdanova and N. Vasylykiv, year 1999 [10]: a) Architectural landscape elements, b) Arranging the theater stage space





il. 5. Parts of master's degree diploma work on topic "The post extensive development concept for architectural environment development in Lviv city», author O. Sinkevych, supervisors: professor V. Proskuryakov, docent B. Goy. General view of high-speed monorail and multifunctional complex "Green hill" at the High Castle mountain. [11]

potential of the «High castle» and «Citadel» mountains which form a kind of a circle around the central part of Lviv city. These areas are proposed to be built with new multifunctional complexes. But taking into account the important ecologic role of these areas for the Lviv central part (since decadent parks are located here) authors offer to build there not the economically relevant tower-like buildings made of steel, glass and concrete but the «green hills» – multi-storey terrace-type houses. Such ones would have great greenery (the system of green roofs and terrace gardens), inter-connected with recreational gallery-like spaces and would be projected with priorities of energy saving and passive energy consuming (or even energy producing). These multifunctional complexes would be a harmonic visual continuation of existing landscape dominants and renew their important role in historical city-building core of the city (il. 12, a, b). [11]

But in modern conditions the «green architecture» is in applied – real projects. Such examples may be in this article author's work. The diploma work on topic «The Svyentoshynska polytechnic campus landscapes design» has been completed in year 2011 at the National University «Polytechnic of Lviv» AED chair under supervision of professor V. Proskuryakov

and senior teacher U. Bogdanova (pic. 6). This work has two high-priority areas highlighted and worked in detail: areas near educational buildings and dormitories. The project wishes to create the environment which would be able to enhance psychological comfort and ecologic environment of this campus area with use of specific "Green architecture" elements. Spaces are planned to be provided with small architecture shapes and greenery: decorative water bodies, benches with ornamental flowerpots for plants, tree plantations, trimmed bushes, lawn, «living" gazebos. Spaces are planned to be settled up as zone of uniting learning and recreation. The whole campus territory has been offered a single style architectural solution which would become a harmonic addition to rectangular volumes of 70s years building. [12]

5. Conclusion

The "Green architecture" development task for projecting and building consists of search-

il. 6. A part of bachelor's work «The Svyentoshynska polytechnic campus landscapes design», completed by student Katola H. O. in year 2011. Supervisors: professor V. Proskuryakov and senior teacher U. Bogdanova



ing for proper place for plants (as a living material) among buildings which would be located in most effective living conditions and become useful and beautiful for surrounding environment while creating a harmonic connection with architectural structures.

The "Green overlay" enhances thermal efficiency, covers from rain, purifies air and replaces green plantations which would be destroyed while building houses and structures.

The use of natural components in architecture forming might be different depending on volume-spacial, functional and constructive issue (interiors, internal yards, roofs, house facades, balconies, terraces, galleries, loggias, separate structures and objects, small architectural shapes, landscape theaters, etc.) All these natural elements use methods enhance aesthetic, psychological, planning, functional, energy efficient and constructive qualities of the building and it's areas. Make possible to decrease noise level, make influence on temperature, refresh volume, make positive effect on people, improve mood, serve as a natural isolation.

The "Green architecture" longs for decreasing buildings negative influence on nature and provide only positive effect on current and next generation lives.

The "Green architecture" definition is long behind the bounds of landscape projecting only. Researching contemporary "green" objects projecting and building experience makes possible to make the following conclusions: the "green architecture" projecting is a new stage of modern architecture development based on principles of connecting natural components with architectural forming.

BIBLIOGRAPHY:

- [1] Katola Kh. Contemporary tendencies of "Green architecture" projecting // The "Actual questions of modern science" conference materials (Kyiv city, October 24-25th 2014). — Kherson : Publishing house "Gelvetyka", 2014. .– p.123–125
- [2] Daures Jean-François , Architecture végétale – Paris, Editions Eyrolles . 2012 – 249.
- [3] Tree shaping // [Electronic Resource]. – Mode of access: URL: http://en.wikipedia.org/wiki/Tree_shaping – Title from the screen.
- [4] Wiechula Arthur, Wachsende Häuser aus lebenden Bäumen entstehend (Developing Houses from Living Trees) – Verl. Naturbau-Ges, 1926– 320 p.
- [5] The architects riot! – Back to roots (The future of architecture) 07 May 2007 // [Electronic Resource]. – Mode of access: URL: <http://buntarh.livejournal.com/35202.html> – Title from the screen.
- [6] Ecodesign sources // [Electronic Resource]. – Mode of access: URL: <http://anysite.ru/publication/arborsculpture> – Title from the screen.
- [7] «Living tower grow roots in German soil», Leonid Popov, 27th of August 2009 // [Electronic Resource]. – Mode of access: URL: <http://www.membrana.ru/particle/1455> – Title from the screen.
- [8] «A very special tree house», 04.02.2010 © BIOPRO Baden-Württemberg GmbH, Prof. Dr. Gerd de Bruyn Dipl. Ing. Ferdinand Ludwig // [Electronic Resource]. – Mode of access: URL: <http://www.bio-pro.de/magazin/index.html?lang=en&artikelid=/artikel/04762/index.html> – Title from the screen.
- [9] Philip Jodidio Green Architecture Now! – Cologne, Taschen, 2009-416p.
- [10] V. Proskuryakov The Ukrainian theater architecture : Space and action / V. I. Proskuryakov ; National University "Polytechnic of Lviv". – L. : National University "Polytechnic of Lviv" publishing house; L. : Silver word, 2004. – 583 p.
- [11] B. Goy, O. Sinkevych The concept of post extensive development as a basis for urbanistic design of Ukrainian cities at the beginning of XXI century (with example of Lviv city / Prydniproviya science news. The "Architecture and city building" series: scientific-practical magazine – Dnipropetrovsk: PDABA, No. 3/ 2011.- P. 72-77
- [12] Katola Kh. The "Green" architecture of university campuses // MESSENGER Architecture No. 793 of the National University "Polytechnic of Lviv" – Lviv: National University "Polytechnic of Lviv" publishing house, 2014. .– p.149–154