

Passive and Low Energy Architecture in Education of Contemporary Architecture

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ABSTRACT: At the beginning of XXI century climatic and sustainable design has been the most actual topic of contemporary architecture. Education of young architects in this area of knowledge should become as advanced as possible. Showing clearly that passive and low energy architecture is not a temporary fashion but the new way of thinking and does not have to be connected with any particular current should become one of the most important goals for the educators. The rich and original exemplification is very important in the teaching process. It helps student understand how sustainable design works in practice. In consequence they are more open for new challenges and creative solutions. Theory and practical experience should be connected in the whole education process. International cooperation, conferences, workshops and practices as well as students contests are highly recommended so that the good examples can be followed and the young generation of architects will promote the worldwide campaign for passive and low energy architecture of the future.

Keywords: education, architecture, energy, bioclimatic, sustainable

1. INTRODUCTION

At the beginning of XXI century climatic and sustainable design has been the most actual topic of contemporary architecture. Education of young architects in this area of knowledge should become as advanced as possible. Nevertheless teaching practice seems to stay behind the science and technology. Certain efforts to change this fact have been undertaken. It is vital to diversify the educational process and to follow the theoretical knowledge with practical works. It is also essential to raise students' consciousness that the architecture safe for the environment has been an unavoidable need of our times on one hand, but on the other hand does not result with any limitation of individual style nor creativeness of the author.

2. THE NEW APPROACH TO ARCHITECTURAL DESIGN

2.1. Common Philosophy. Any Style is Welcome

XXI century should start with the radical change of typical but old fashioned approach presented in the polemic between Peter Eisenman and Leon Krier "My ideology is better than yours" (Eisenman, Krier 1989) [1]. Many designers believe that climatic architecture has been a part of Eco-Tech movement which they regard to be nothing but the evolution of High-Tech logic. For the opponents that kind of design does not leave enough space for the creativeness, imagination and personal style of the designer. Showing clearly that passive and low energy architecture does not have to be connected with any particular current should become one of the most important goals for the educators.

Villa A (Fig. 1), located on the slope of the Poesting Berg, a mountain in Linz, Austria,

designed by Najjar & Najjar Architects (2010), represents the example of low energy building. On the southern and western side of the house the roof cantilevers beyond the terraces to provide an efficient sun protection in the summer while in the winter the low sun angle allows controlled entry of the natural light into the interior space.



Fig. 1: Villa A, Linz, Austria, designed by Najjar & Najjar Architects (2010) represents an example of low energy building. © Manfred Seidl.



Fig. 2: Villa A, Linz, Austria, Najjar & Najjar Architects (2010). Daylight can enter through the openwork roof and terrace glazing. © Manfred Seidl.

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Passive and Low Energy Ecotechniques Arthur Bowen, Simos Yannas, 2013-09-03 Passive and Low Energy Ecotechniques PLEA presents the proceedings of the Third International PLEA Conference held in Mexico City Mexico on August 6 11 1984 The book includes papers on state of the art selected topics aimed at providing a basic knowledge country and regional or personal monographs to continue the exchange of national information which is an established feature of PLEA and position papers for the topic seminars The text also presents papers on vernacular shelter and settlement case studies of new buildings and retrofits urban and community planning and design photovoltaic systems implementation cooling systems modeling and simulation guidelines and tools for design and planning *Passive Low Energy Cooling of Buildings* Baruch Givoni, 1994-07-27 A practical sourcebook for building designers providing comprehensive discussion of the impact of basic architectural choices on cooling efficiency including the layout and orientation of the structure window size and shading exterior color and even the use of plantings around the site All major varieties of passive cooling systems are presented with extensive analysis of performance in different types of buildings and in different climates ventilation radiant cooling evaporative cooling soil cooling and cooling of outdoor spaces Environmentally Friendly Cities Eduardo Maldonado, 2014-11-19 The 15th Passive and Low Energy Architecture PLEA conference considered the issues of sustainability and environmental friendliness at the city scale Some 150 papers address the many and varied questions faced by architects and planners in reducing the impact on the environment of cities and their buildings *Carbon-Neutral Architectural Design* Pablo M. La Roche, 2016-04-19 The energy used to operate buildings is one of the most significant sources of greenhouse gas emissions To lessen the human impact on climate it is necessary to reduce these building related emissions New legislation as well as market and financial pressures are driving architects and developers to create low carbon buildings While it is possible to achieve many of these reductions through appropriate climate responsive design many architects are not trained to do this Filling an urgent need for a design reference in this emerging field Carbon Neutral Architectural Design describes how to reduce building related greenhouse gas emissions through appropriate design techniques This full color book presents strategies and methods to achieve CO2 reductions with an emphasis on control of energy flows through the building envelope and passive heating and cooling strategies Strategies for Designing Buildings with a Smaller Carbon Footprint Examining climate change and its relationship with buildings the book begins with a look at the sources of emissions and how these are produced as a result of interactions between buildings and the surrounding environment It then introduces a carbon neutral architectural design process CNDP and a roadmap that can be adjusted for different types of projects Discussing climate analysis and solar geometry the book explores how understanding the climate where a building is located helps to identify the design strategies that are best suited to that location whether warm and humid warm and dry temperate or cold It looks at psychrometrics and how to achieve thermal comfort with minimum

emissions The book also explains how building fabric can be used to control energy flows by conduction radiation and convection helping to reduce overheating and overcooling and how to incorporate passive cooling and heating systems through appropriate design The book includes useful references equations and illustrations as well as a comparison of free carbon counting tools that can be used for residential building design Drawing on the author s extensive experience in teaching and practice this is a valuable resource for anyone who wants to reduce the carbon footprint of buildings Find more study resources at the American Institute of Architects Carbon Neutral Design Project web site What s next for green building See what Dr La Roche has to say in this video on the HMC Architects blog **Architecture & Sustainable**

Development (vol.1) Magali Bodart,Arnaud Evrard,2011-07 This book of Proceedings presents the latest thinking and research in the rapidly evolving world of architecture and sustainable development through 255 selected papers by authors coming from over 60 countries *Eco-Architecture V* C.A. Brebbia,R. Pulselli,2014-09-24 This book contains the proceedings of the fifth International Conference on Harmonisation between Architecture and Nature Eco Architecture 2014 Eco Architecture implies a new approach to the design process intended to harmonise its products with nature This involves ideas such as minimum use of energy at each stage of the building process taking into account the amount required during the extraction and transportation of materials their fabrication assembly building erection maintenance and eventual future recycling Another important issue is the adaptation of the architectural design to the natural environment learning from nature and long time honoured samples of traditional constructions The papers in this book deal with topics such as building technologies design by passive systems design with nature cultural sensitivity life cycle assessment resources and rehabilitation and many others Also included are case studies from many different places around the world Eco Architecture by definition is a highly multi disciplinary subject Eco Architecture V Harmonisation between Architecture and Nature will therefore be of interest to in addition to architects many other professionals including engineers planners physical scientists sociologists and economists Topics covered include Design with nature Energy efficiency Building technologies Ecological impacts of materials Bioclimatic design Water quality Green facades Ecological and cultural sensitivity Education and training Case studies Design by passive systems Adapted reuse Life cycle assessment and durability Transformative design Sustainability indices in architecture **Passive Solar Buildings** J. Douglas Balcomb,1992 Describes developments in passive solar technology that will save time energy and resources in planning for the buildings of the future This companion to Passive Cooling and Solar Building Architecture volumes 8 and 9 describes developments in passive solar technology that will save time energy and resources in planning for the buildings of the future It is filled with tips and useful research for architects and designers and includes three substantial chapters on general modeling Passive solar heating works Properly designed and constructed it is cost effective practical comfortable and aesthetic Balcomb s introductory remarks set the tone for the rest of the contributions which describe the considerable record of achievements in passive solar heating Balcomb

summarizes and evaluates the era between 1976 and 1983 when most of the major developments took place and highlights the design features that have contributed to effective buildings Three chapters cover modeling passive systems applicable to both heating and cooling and six chapters focus on the application of passive solar heating with emphasis on components analytical results for specific systems test modules subsystem integration into buildings performance monitoring and results and design tools J Douglas Balcomb is a Principal Engineer with the Solar Energy Research Institute

Computer Modelling for Sustainable Urban Design Darren Robinson, 2012-11-12 This is the first book to directly address the physics of urban sustainability and how urban sustainability may be modelled and optimised Starting with an introduction to the importance and key aspects of the topic it moves on to a detailed consideration of the urban climate and pedestrian comfort Comprehensive techniques for the modelling and optimisation of urban metabolism are then described together with means for defining sustainability as the fitness function to be optimised It ends with an eye to the future of sustainable urban design and the means available to urban designers and governors to help them to secure a more sustainable urban future This book will be invaluable both in informing the next generation of urban planners architects and engineers and as a tool to current professionals that will directly contribute to the effectiveness of their work by allowing them to more successfully measure and model urban sustainability

Eco-Architecture VI V. Echarri, C. A. Brebbia, 2016-08-31 Comprising of the proceedings of the Sixth International Conference on Harmonisation between Architecture and Nature the papers deal with topics such as building technologies design by passive systems design with nature cultural sensitivity life cycle assessment resources and rehabilitation as well as many others This book follows five successful meetings which started in the New Forest UK in 2006 then followed in the Algarve 2008 A Coruna 2010 Kos 2012 and Siena Italy 2014 Eco Architecture signifies a new approach to the design process intended to harmonise its products with nature This involves concepts such as minimum use of energy at each stage of the building process taking into account the amount required during the extraction and transportation of materials their fabrication assembly building formation maintenance and eventual future recycling The adaptation of the architectural design to the natural environment is another important issue The book will be of interest to architects engineers planners physical scientists sociologists and economists and contained within these proceedings are case studies from many different places around the world Topics covered consist of Design with nature Energy efficiency Tall buildings and environment Ecological impacts of materials Biomaterials Bioclimatic design Water quality Green facades Ecological Education and training Adapted reuse Transformative design Sustainability indices in architecture Bioclimatic design and passive systems Recycle reuse reduce and recovery Mixing it up and building flexibility Architectural visualisation and New techniques building information modelling

eWork and eBusiness in Architecture, Engineering and Construction Alain Zarli, Raimar Scherer, 2008-09-03 Since 1994 the European Conference on Product and Process Modelling www.ecppm.org has been providing a review of research development and industrial implementation of product

and process model technology in construction The 7th European Conference on Product and Process Modelling ECPPM 2008 provided a unique discussion platform for topics of **Climate Considerations in Building and Urban Design** Baruch Givoni, 1998-01-20 Climate Considerations in Building and Urban Design Baruch Givoni Climate Considerations in Building and Urban Design is the most comprehensive up to date reference available on building and urban climatology Written in clear common sense language by Baruch Givoni the leading authority in the field this book is a far reaching look at a variety of climatic influences and their effects on individuals buildings and communities Aimed at architecture and urban planning professionals and students alike Climate Considerations in Building and Urban Design offers real life solutions to climatological site planning and design issues helping to settle disputes about site orientation site organization and the assembly of building materials Climate Considerations in Building and Urban Design is organized into three parts The first Building Climatology analyzes human thermal comfort and the effect of architectural and structural design features including layout window orientation and shading and ventilation conditions on the indoor climate Then Urban Climatology explores the ways in which the climate in densely built areas can differ from surrounding regional climatic conditions for example in temperature wind speed and humidity This part further explores the effects of urban design elements such as urban density and building height on a city's outdoor climate Finally Building and Urban Design Guidelines applies the body of available research on building climatology and the effects of physical planning on the urban and indoor climates to suggest design guidelines for different regions for example hot dry and hot humid climates Filled with lists tables and graphs for easy cross referencing as well as hundreds of visuals Climate Considerations in Building and Urban Design offers readers the ability to perform a quick check of a proposed scheme against authoritative criteria Mr Givoni's latest volume is a unique indispensable guide to the relationship between building design urban planning and climate **Adaptive Thermal**

Comfort: Principles and Practice Fergus Nicol, Michael Humphreys, Susan Roaf, 2012-03-15 The fundamental function of buildings is to provide safe and healthy shelter For the fortunate they also provide comfort and delight In the twentieth century comfort became a product produced by machines and run on cheap energy In a world where fossil fuels are becoming ever scarcer and more expensive and the climate more extreme the challenge of designing comfortable buildings today requires a new approach This timely book is the first in a trilogy from leaders in the field which will provide just that It explains in a clear and comprehensible manner how we stay comfortable by using our bodies minds buildings and their systems to adapt to indoor and outdoor conditions which change with the weather and the climate The book is in two sections The first introduces the principles on which the theory of adaptive thermal comfort is based The second explains how to use field studies to measure thermal comfort in practice and to analyze the data gathered Architects have gradually passed responsibility for building performance to service engineers who are largely trained to see comfort as the product designed using simplistic comfort models The result has contributed to a shift to buildings that use ever more energy A growing

international consensus now calls for low energy buildings This means designers must first produce robust passive structures that provide occupants with many opportunities to make changes to suit their environmental needs Ventilation using free natural energy should be preferred and mechanical conditioning only used when the climate demands it This book outlines the theory of adaptive thermal comfort that is essential to understand and inform such building designs This book should be required reading for all students teachers and practitioners of architecture building engineering and management for all who have a role in producing and occupying twenty first century adaptive low carbon comfortable buildings The Architecture of Natural Cooling Brian Ford,Rosa Schiano-Phan,Juan A. Vallejo,2019-11-15 Overheating in buildings is commonplace This book describes how we can keep cool without conventional air conditioning improving comfort and productivity while reducing energy costs and carbon emissions It provides architects engineers and policy makers with a how to guide to the application of natural cooling in new and existing buildings It demonstrates through reference to numerous examples that natural cooling is viable in most climates around the world This completely revised and expanded second edition includes An overview of natural cooling past and present Guidance on the principles and strategies that can be adopted A review of the applicability of different strategies Explanation of simplified tools for performance assessment A review of components and controls A detailed evaluation of case studies from the USA Europe India and China This book is not just for the technical specialist as it also provides a general grounding in how to avoid or minimise air conditioning Importantly it demonstrates that understanding our environment rather than fighting it will help us to live sustainably in our rapidly warming world

Building Performance Simulation for Design and Operation Jan L.M. Hensen,Roberto Lamberts,2012-09-10 Effective building performance simulation can reduce the environmental impact of the built environment improve indoor quality and productivity and facilitate future innovation and technological progress in construction It draws on many disciplines including physics mathematics material science biophysics and human behavioural environmental and computational sciences The discipline itself is continuously evolving and maturing and improvements in model robustness and fidelity are constantly being made This has sparked a new agenda focusing on the effectiveness of simulation in building life cycle processes Building Performance Simulation for Design and Operation begins with an introduction to the concepts of performance indicators and targets followed by a discussion on the role of building simulation in performance based building design and operation This sets the ground for in depth discussion of performance prediction for energy demand indoor environmental quality including thermal visual indoor air quality and moisture phenomena HVAC and renewable system performance urban level modelling building operational optimization and automation Produced in cooperation with the International Building Performance Simulation Association IBPSA and featuring contributions from fourteen internationally recognised experts in this field this book provides a unique and comprehensive overview of building performance simulation for the complete building life cycle from conception to demolition It is primarily intended for advanced students in building

services engineering and in architectural environmental or mechanical engineering and will be useful for building and systems designers and operators

Roll-to-Roll Vacuum Deposition of Barrier Coatings Charles A. Bishop, 2015-08-28
 It is intended that the book will be a practical guide to provide any reader with the basic information to help them understand what is necessary in order to produce a good barrier coated web or to improve the quality of any existing barrier product After providing an introduction where the terminology is outlined and some of the science is given keeping the mathematics to a minimum including barrier testing methods the vacuum deposition process will be described In theory a thin layer of metal or glass like material should be enough to convert any polymer film into a perfect barrier material The reality is that all barrier coatings have their performance limited by the defects in the coating This book looks at the whole process from the source materials through to the post deposition handling of the coated material This holistic view of the vacuum coating process provides a description of the common sources of defects and includes the possible methods of limiting the defects This enables readers to decide where their development efforts and money can best be used to improve the barrier performance of their own process or materials The 2nd edition contains at least 20% new material including additional barrier testing techniques that have been developed and testing and cleaning equipment brought to market since the 1st edition was published in 2010 The topic of adhesion is covered in more detail and there is a section on the Hansen Solubility Parameter which is a method of predicting the solubility of gases or liquids in materials

Universal Access in Human-Computer Interaction: Design for All and Accessibility Practice Constantine Stephanidis, Margherita Antona, 2014-05-16 The four volume set LNCS 8513 8516 constitutes the refereed proceedings of the 8th International Conference on Universal Access in Human Computer Interaction UAHCI 2014 held as part of the 16th International Conference on Human Computer Interaction HCII 2014 held in Heraklion Crete Greece in June 2014 jointly with 14 other thematically similar conferences The total of 1476 papers and 220 posters presented at the HCII 2014 conferences was carefully reviewed and selected from 4766 submissions These papers address the latest research and development efforts and highlight the human aspects of design and use of computing systems The papers thoroughly cover the entire field of human computer interaction addressing major advances in knowledge and effective use of computers in a variety of application areas The total of 251 contributions included in the UAHCI proceedings were carefully reviewed and selected for inclusion in this four volume set The 60 papers included in this volume are organized in the following topical sections web accessibility design for all in the built environment global access infrastructures and user experiences in universal access

Physics and Technology of Solar Energy H.P. Garg, M. Dayal, G. Furlan, A.A.M Sayigh, 2012-12-06 The fuel crises in 1972 73 generated world wide effort for the search for an Alternative Energy source to fossil fuels Solar energy was identified as one of the alternatives to fossil fuels On one hand the developed countries are trying to maintain their standard of living while the developing countries are trying to solve their industrial social and economical problems to increase their

standard of living After this period a lot of Research and Development in the field of solar energy was carried out both in developing and developed countries and solar energy is utilized in domestic agricultural and industrial sectors and also in the space During the period of Oil Crises industrialized countries expended their activities in solar energy and substantial progress was made In few developing countries separate funding in the field of solar energy R D was also provided through national and international organizations Time has now come when one should seriously look into the problems and screen select adapt and manage emerging solar energy technology for its use in developing countries Also the International Organizations will have to play a major role in this direction which may assist building up of a local Solar energy R D and manufacturing capabilities in developing countries which should be based on a long term but on necessary basis

Assessment of Daylight Performance in Buildings B. Gherri, 2015-04-08 This title deals with the many advantages associated to the use of natural light comparing architectural experiences technological devices and calculation methods It provides an introduction to the problems and solutions of enhancing and conveying the right dose of daylight inside buildings giving attention to energy savings and visual comfort **Energy Storage Systems** Birol Kilkis, Sadik Kakaç, 2012-12-06 Proceedings of the NATO Advanced Study Institute esme Izmir Turkey 27 June 8 July 1988 Earth Shelter Technology Lester L. Boyer, Walter T. Grondzik, 1987 Discusses shelter design concepts as passive cooling passive solar heating daylighting and hazard protection for all regions and climates at the same time evaluating shelter performance in terms of comfort and habitability cooling and heating effectiveness and levels of protection

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