

12th Nordic Symposium on Building Physics (NSB 2020)

E3S Web of Conferences Volume 172 (2020)

Tallinn, Estonia
6-9 September 2020

Part 1 of 3

Editors:

Jarek Kurnitski
Targo Kalamees

ISBN: 978-1-7138-1433-7

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

This work is licensed under a Creative Commons Attribution 4.0 International License. License details:
<http://creativecommons.org/licenses/by/4.0/>.

No changes have been made to the content of these proceedings. There may be changes to pagination and minor adjustments for aesthetics.

Printed with permission by Curran Associates, Inc. (2021)

For additional information, please contact EDP Sciences – Web of Conferences at the address below.

EDP Sciences – Web of Conferences
17, Avenue du Hoggar
Parc d'Activité de Courtabœuf
BP 112
F-91944 Les Ulis Cedex A
France

Phone: +33 (0) 1 69 18 75 75
Fax: +33 (0) 1 69 28 84 91

contact-edps@webofconferences.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

PART 1

MOISTURE PERFORMANCE OF A NEW THERMAL INSULATION COMPOSITE FOR INTERIOR APPLICATION	1
<i>Rode Carsten, Friis Naja Kastrup, Pedersen Christian, Feldt Jensen Nickolaj</i>	
EVALUATION OF THE RISK OF DECAY OF WOODEN BEAMS EMBEDDED IN INTERNALLY INSULATED WALLS BY LONG-TERM MEASUREMENTS	10
<i>De Mets Timo, Tilmans Antoine</i>	
INTERNAL INSULATION OF SOLID MASONRY WALLS – FIELD EXPERIMENT WITH PHENOLIC FOAM AND LIME-CORK BASED INSULATING PLASTER.....	18
<i>Jensen Nickolaj Feldt, Rode Carsten, Andersen Birgitte, Bjarlov Soren Peter, Moller Eva B.</i>	
GUIDELINES FOR INTERNAL INSULATION OF HISTORIC BUILDINGS.....	26
<i>De Place Hansen Ernst Jan, Moller Eva B., Orsager Morten</i>	
MOISTURE IN WALLS BEFORE AND AFTER INTERNAL WALL INSULATION: A LONG-TERM IN-SITU DATASET	33
<i>Grint Naomi, Elwell Clifford A.</i>	
INTERNAL WALL INSULATION WITH A NEW AEROGEL PANEL: SLENTITE® FOR ENERGETIC RETROFIT IN HISTORIC BUILDINGS	41
<i>Günther Eva, Bichlmair Stefan, Latz Sebastian, Fricke Marc</i>	
TOWARDS THE EVALUATION OF A THERMAL COMPARTMENTATION RENOVATION CONCEPT THROUGH IN-SITU MEASUREMENTS.....	47
<i>Rovers Twan, Struck Christian, Van 't Ende Jeroen</i>	
MEASUREMENTS BEHIND INTERNAL INSULATION ON SOLID MASONRY WALLS WITH DIFFERENT ORIENTATIONS AND DEGREES OF REPAIR IN A DANISH MULTI-STORY BUILDING.....	51
<i>Vanhoutteghem Lies, Haker Hoegh Britt, Hansen Thor</i>	
HYGRO-THERMAL PERFORMANCE OF WOODEN BEAM ENDS: EXPERIMENTAL INVESTIGATIONS OF UNINSULATED AND INTERNALLY INSULATED BRICK WALL	58
<i>Kopecký Pavel, Stanik Kamil, Tywoniak Jan</i>	
ENERGY AND INDOOR THERMAL COMFORT PERFORMANCE OF A SWEDISH RESIDENTIAL BUILDING UNDER FUTURE CLIMATE CHANGE CONDITIONS	63
<i>Dodoo Ambrose</i>	
RESILIENCE OF CANADIAN HOMES AND SMALL BUILDINGS TO THE EFFECTS OF CLIMATE CHANGE - RISK OF DETERIORATION DUE TO CONDENSATION WITHIN WALL ASSEMBLIES	71
<i>Defo Maurice, Lacasse Michael</i>	
COOLING OF SCHOOLS – RESULTS FROM A DEMONSTRATION PROJECT USING ADIABATIC EVAPORATIVE COOLING WITH HARVESTED RAINWATER.....	81
<i>Hviid Christian A., Zukowska-Tejsen Daria, Nielsen Vilhjalmur</i>	

OVERHEATING RISK OF A SINGLE-FAMILY DETACHED HOUSE BUILT AT DIFFERENT AGES UNDER CURRENT AND FUTURE CLIMATE IN CANADA	87
<i>Baba Fuad Mutasim, Ge Hua</i>	
THE EFFECT OF SEASONAL WEATHER CHANGES ON THE PERFORMANCE OF DATABASED MODELS OF THE THERMODYNAMIC BEHAVIOUR OF BUILDINGS	94
<i>Hauge Broholt Thea, Raevdal Lund Christensen Louise, Dahl Knudsen Michael, Elbaek Hedegaard Rasmus, Petersen Steffen</i>	
THE IMPACT OF CLIMATE CHANGE ON MATERIAL DEGRADATION CRITERIA IN HERITAGE OVER IRAN: REGIONAL CLIMATE MODEL EVALUATION.....	102
<i>Hedayatnia Hamed, Steeman Marijke, Van Den Bossche Nathan</i>	
OVERHEATING RISK OF A TYPICAL NORWEGIAN RESIDENTIAL BUILDING RETROFITTED TO HIGHER ENERGY STANDARDS UNDER FUTURE CLIMATE CONDITIONS.....	110
<i>Tian Zhiyong, Hrynyszyn Bozena Dorota</i>	
IMPACT ASSESSMENT OF CLIMATE CHANGE ON THE ENERGY PERFORMANCE OF THE BUILDING STOCKS IN FOUR EUROPEAN CITIES	117
<i>Yang Yuchen, Javanroodi Kavan, Nik Vahid M.</i>	
MANAGING CLIMATE-CHANGE-INDUCED OVERHEATING IN NON-RESIDENTIAL BUILDINGS	124
<i>Badura André, Mueller Birgit, Martinac Ivo</i>	
THE INFLUENCE OF UNMEASURED OCCUPANCY DISTURBANCES ON THE PERFORMANCE OF BLACK-BOX THERMAL BUILDING MODELS.....	130
<i>Raevdal Lund Christensen Louise, Hauge Broholt Thea, Dahl Knudsen Michael, Elbaek Hedegaard Rasmus, Petersen Steffen</i>	
DESIGN OF SMART WETTING OF BUILDING MATERIALS AS EVAPORATIVE COOLING MEASURE FOR IMPROVING THE URBAN CLIMATE DURING HEAT WAVES	136
<i>Ferrari Andrea, Kubilay Aytac, Derome Dominique, Carmeliet Jan</i>	
USE OF A RADIATOR FOR USER-CENTRIC COOLING – MEASUREMENT AND SIMULATION	144
<i>Winkler Matthias, Pazold Matthias, Zegowitz Andreas, Giglmeier Sabine, Antretter Florian</i>	
POSSIBILITIES OF COMBINING RADIANT WALL COOLING WITH EJECTOR COOLING CYCLE POWERED BY FRESNEL SOLAR COLLECTORS	150
<i>Krajeik Michal, Masaryk Michal, Simko Martin, Mlynár Peter</i>	
THERMAL MASS AND THE EFFECTS ON HEATING AND COOLING DEMANDS – AN EXPERIMENTAL STUDY OF AN EXPOSED CONCRETE FLOOR.....	158
<i>Nocente Alessandro, Grynning Steinar</i>	
INVESTIGATING OVERHEATING BY MEASUREMENT AND SIMULATION IN CLASSROOMS	166
<i>Pazold Matthias, Winkler Matthias, Antretter Florian</i>	
NIR REFLECTIVE PIGMENTS TO MITIGATE THE URBAN HEAT ISLANDS EFFECT (UHIE).....	174
<i>Rosati Andrea, Fedel Michele, Rossi Stefano</i>	

VALIDATION OF MODELS FOR THE CALCULATION OF SUN POSITIONS AND MAPPED RADIATION ON INCLINED SURFACES	179
<i>Hirth Stephan, Weiß Dirk, Nicolai Andreas, Grunewald John</i>	
COMPUTATIONAL FLUID DYNAMICS ANALYSIS IN THE DUCTLESS WHOLE-HOUSE AIR CONDITIONING SYSTEM	187
<i>Tasaka Rie, Kindaichi Sayaka, Nishina Daisaku, Maeoki Mitsuhiro</i>	
LIGHTWEIGHT TIMBER-FRAMED WALL AND IMPACT OF VENTILATED CLADDING ON THE POSSIBILITY OF REDUCING SUMMER OVERHEATING IN CENTRAL EUROPE	191
<i>Juras Peter</i>	
DESIGN OPTIMIZATION OF A BUILDING ATTACHED SUNSPACE THROUGH EXPERIMENTAL MONITORING AND DYNAMIC MODELLING.....	197
<i>Guasco Martina, Orlanno Martina, Piccardo Chiara, Giachetta Andrea, Dodoo Ambrose</i>	
USING CONVOLUTIONAL NEURAL NETWORKS FOR HYGROTHERMAL PREDICTIONS TO EXTRAPOLATE TO OTHER EXTERNAL CLIMATES	205
<i>Tijskens Astrid, Janssen Hans, Roels Staf</i>	
THE USE OF POD-DEIM MODEL ORDER REDUCTION FOR THE SIMULATION OF NONLINEAR HYGROTHERMAL PROBLEMS	211
<i>Hou Tianfeng, Meerbergen Karl, Roels Staf, Janssen Hans</i>	
TESTING OF A NEW NON-EQUILIBRIUM HEAT AND MOISTURE TRANSFER MODEL IN POROUS BUILDING MATERIALS	217
<i>Łapka Piotr, Wasik Micha, Ciećlikiewicz Łukasz, Furmanski Piotr</i>	
PORE SCALE MODELLING OF MOISTURE TRANSFER IN BUILDING MATERIALS WITH THE PHASE FIELD METHOD	223
<i>Bianchi Janetti Michele, Janssen Hans</i>	
WATER VAPOR TRANSPORT TO A SEMI-INFINITE MATERIAL WITH SIMULTANEOUS VARYING SURFACE RELATIVE HUMIDITY AND TEMPERATURE.....	231
<i>Hagentoft Carl-Eric</i>	
SENSITIVITY AND UNCERTAINTY ANALYSES ON A DELPHIN MODEL: THE IMPACT OF MATERIAL PROPERTIES ON MOISTURE IN A SOLID BRICK WALL.....	237
<i>Grint Naomi, Marincioni Valentina, Elwell Clifford A.</i>	
EFFICIENT HYGROTHERMAL WALL TRANSPORT MODELS INSIDE SIMULATIONS OF CONDITIONED BUILDINGS	245
<i>Paepcke Anne, Nicolai Andreas</i>	
MODELLING THE MOISTURE REDISTRIBUTION IN CONCRETE FLOORS WITH SCREED AND FLOORING MATERIAL WITH VARYING PROPERTIES.....	252
<i>Nilsson Lars-Olof, Olsson Nilla, Mundt-Petersen S. Olof, Lindmark Sture, Lindskog Mathias, Kumlin Anders, Oxfall Mikael, Tannfors Johan</i>	
ANALYTICAL SOLUTIONS OF WATER SUCTION AND DRYING PROCESSES VS. EXPERIMENTS	258
<i>Matiasovsky Peter, Mihalka Peter</i>	
VALIDATION OF HYGROTHERMAL SIMULATIONS WITH WALL PERFORMANCE EXPERIMENTS IN AN ENVIRONMENTAL CHAMBER.....	262
<i>Salonvaara Mikael, Boudreaux Philip, Desjarlais Andre, Antretter Florian, Werling Eric</i>	

A NEW TOOL FOR THE DRYING TIME AND THE MOISTURE RISK ESTIMATION IN CONCRETE FLOORS.....	270
<i>Sekki Pauli, Marttila Pasi, Merikallio Tarja</i>	
PRESSURE DIFFERENCE IN BUILDINGS WITH GOOD AIR-TIGHTNESS: CONTROL MEASUREMENTS AFTER IAQ RENOVATIONS.....	275
<i>Laine Katariina</i>	
INFLUENCE OF BUILDING ENVELOPE TYPE ON THE MINIMUM MECHANICAL VENTILATION RATE TO ACHIEVE A POSITIVE INDOOR AIR PRESSURE.....	280
<i>Shi Yuchen, Li Xiaofeng, Sadatiseyedmahalleh Seyedehelham</i>	
USE OF RADON BARRIERS TO REACH AN ACCEPTABLE RADON LEVEL	285
<i>Valdbjorn Rasmussen Torben, Cornelius Thomas</i>	
THE IMPACT OF INFILTRATION ON HEATING SYSTEMS DIMENSIONING IN ESTONIAN CLIMATE	292
<i>Simson Raimo, Rebane Taaniel, Kiil Martin, Thalfeldt Martin, Kurnitski Jarek</i>	
A PROSPECTIVE STUDY ON THE EVOLUTION OF AIRTIGHTNESS IN 41 LOW ENERGY DWELLINGS.....	300
<i>Verbeke Stijn, Audenaert Amaryllis</i>	
ASSESSMENT OF WIND IMPACT ON BUILDING AIR LEAKAGE MEASUREMENTS USING A MODEL SCALE EXPERIMENT	306
<i>Mélois Adeline Bailly, Tran Anh Dung, El Mankibi Mohamed, Carrié François Rémi, Moujalled Bassam, Guyot Gaëlle</i>	
OVERVIEW OF LARGE BUILDING TESTING IN BALTIC COUNTRIES.....	314
<i>Nitijeviskis Andrejs, Keviss Vladislavs</i>	
INFLUENCE OF AIRTIGHTNESS OF STEEL SANDWICH PANEL JOINTS ON HEAT LOSSES	318
<i>Kuhnhenne Markus, Reger Vitali, Pyschny Dominik, Doring Bernd</i>	
DEVELOPMENT OF AIR TIGHTNESS PREDICTION METHOD OF MASONRY WALLS.....	324
<i>Geleziunas Valdemaras, Banionis Karolis, Paukstys Valdas, Kumziene Jurga</i>	
AIR LEAKAGE PATHS IN BUILDINGS: TYPICAL LOCATIONS AND IMPLICATIONS FOR THE AIR CHANGE RATE	331
<i>Gullbrekken Lars, Schjoth Bunkholt Nora, Geving Stig, Rùther Petra</i>	
CHANGES TO STRUCTURAL SOLUTIONS AND THEIR EFFECT ON RADON FUNCTIONALITY ON THE STRUCTURES BASE ON THE GROUND.....	337
<i>Kettunen Ari-Veikko</i>	
THERMAL COMFORT, THERMAL SENSATION AND SKIN TEMPERATURE MEASUREMENTS USING DEMAND-CONTROLLED VENTILATION FOR INDIVIDUAL COOLING.....	341
<i>Solberg Hakon, Thunshelle Kari, Schild Peter</i>	
EFFECT OF MOISTURE BUFFERING ON SURFACE TEMPERATURE VARIATION: STUDY OF DIFFERENT INDOOR CLADDING MATERIALS	348
<i>Legros Clémence, Piot Amandine, Woloszyn Monika, Pailha Mickael</i>	

COLD WINDOWS INDUCED AIRFLOW EFFECTS ON THE THERMAL ENVIRONMENT FOR A LARGE SINGLE-ZONE BUILDING.....	355
<i>Zhang Ying, Olofsson Thomas, Nair Gireesh, Zhao Chenbo, Yang Bin, Li Angui</i>	
THERMAL COMFORT: STANDARD COMPLIANT MODELLING OF NATURAL VENTILATION IN ADAPTIVE TIME STEP SOLVERS.....	361
<i>Andreas Nicolai, Heiko Fechner</i>	
FIELD MEASUREMENTS AND CFD SIMULATION OF A ROOM IN AN ELDERLY CARE CENTER IN LITHUANIA TO EVALUATE AIR QUALITY AND THERMAL COMFORT.....	368
<i>Dobravalskis Mantas, Seduikyte Lina, Didziariekyte Ugne</i>	
CLOTHING BEHAVIOUR IN BELGIAN HOMES.....	375
<i>Verbruggen Silke, De Ceuster Els, Delghust Marc, Laverge Jelle</i>	
EARLY-STAGE CONCENTRATIONS OF FORMALDEHYDES AND TVOCs IN A NEW LOW-ENERGY BUILDING	381
<i>Sasic Kalagasidis Angela, Domhagen Fredrik, Langer Sarka</i>	
INTERNAL PARTICULATE MATTER POLLUTION IN EDUCATIONAL BUILDING.....	386
<i>Nowak-Dzieszko K., Kisilewicz T.</i>	
THE HUMAN COMFORT LEVEL IN AN ENERGY-SAVING SIMULATION MODEL OF OFFICE BUILDING	393
<i>Dzelzitis Egils, Sidenko Sandra</i>	
THE AMBIVALENCE OF PERSONAL CONTROL OVER INDOOR CLIMATE – HOW MUCH PERSONAL CONTROL IS ADEQUATE?.....	400
<i>Hellwig Runa T., Schweiker Marcel, Boerstra Atze</i>	
OCCUPANT COMFORT IN NEARLY ZERO ENERGY BUILDINGS (NZEB) BY USING THE BUILDING STRUCTURE FOR DEMAND SIDE MANAGEMENT (DMS).....	408
<i>Sigg Ferdinand, Krause Harald</i>	
SENSITIVITY OF THE HYGROTHERMAL BEHAVIOUR OF HOMOGENEOUS MASONRY CONSTRUCTIONS: FROM SOBOl INDICES TO DECISION TREES.....	414
<i>Calle Klaas, Van Den Bossche Nathan</i>	
HYGROTHERMAL PERFORMANCE OF TIMBER FRAME WALLS WITH BRICK VENEER CLADDING: A PARAMETER ANALYSIS	420
<i>Vanpachtenbeke Michiel, Van Den Bulcke Jan, Van Acker Joris, Roels Staf</i>	
HYGROTHERMAL BEHAVIOUR OF VENTILATION CAVITIES IN HIGHLY INSULATED ENVELOPES	428
<i>Viljanen Klaus, Lü Xiaoshu, Puttonen Jari</i>	
HIGHLY INSULATED CRAWL SPACES WITH CONTROLLED MINIMAL VENTILATION – PROOF OF CONCEPT BY FIELD MEASUREMENTS.....	438
<i>Airaksinen Miimu, Olsson Lars, Kurnitski Jarek, Hvidberg Staffan</i>	
HYDROTHERMAL PERFORMANCE OF THE EXTERNAL WOODEN FRAME WALL STRUCTURE REINFORCED WITH BALLISTIC PANELS	443
<i>Borodinecs Anatolijs, Prozuments Aleksejs, Zemitis Jurgis, Zajecs Deniss, Bebre Guna</i>	
INFLUENCE OF THE LATERAL SOURCE/BUILDING SEPARATION ON VAPOUR INTRUSION: A NUMERICAL STUDY	449
<i>Rios Mora Juan Sebastian, Collignan Bernard, Diallo Thierno, Abadie Marc, Limam Karim</i>	

TREATMENT OF CONDENSATION IN SANDWICH PANELS WITHOUT KNOWN VAPOUR RESISTANCE OF SEALANT	455
<i>Vidmar Gregor</i>	
HYGROTHERMAL CONDITIONS IN VENTILATED ATTICS WITH DIFFERENT AIR CHANGE RATES AND CEILING CONSTRUCTIONS	462
<i>Morelli Martin, Moller Eva, Hansen Thor</i>	
THE DEVELOPMENT OF EMPD MODEL FOR IDENTIFYING AND PREDICTING THE MATERIALS' MOISTURE PERFORMANCES	469
<i>Cui Yumeng, Zhang Yufeng, Zhao Huihui, Lin Xue</i>	
COMPACT WOODEN ROOFS WITH SMART VAPOUR BARRIER – PILOT PROJECT EXPERIENCES	477
<i>Schjoth Bunkholt Nora, Gullbrekken Lars, Geving Stig, Kvande Tore</i>	
EXPERIMENTAL INVESTIGATION AND HYGROTHERMAL MODELLING OF FREEZE- THAW PROCESS OF SATURATED FIRED CLAY MATERIALS INCLUDING SUPERCOOLING PHENOMENON.....	485
<i>Fukui Kazuma, Iba Chiemi, Taniguchi Madoka, Takahashi Kouichi, Ogura Daisuke</i>	
THERMAL BRIDGE EFFECT OF VERTICAL DIAGONAL TIE CONNECTORS IN PRECAST CONCRETE SANDWICH PANELS: AN EXPERIMENTAL AND COMPUTATIONAL STUDY	492
<i>Kloseiko Paul, Piir Reimo, Jeltsov Marti, Kalamees Targo</i>	
STOCHASTIC GENERATION OF MULTISCALE 3D PORE NETWORK MODELS OF BUILDING MATERIALS	499
<i>Claes Steven, Janssen Hans</i>	
TWO-DIMENSIONAL HYGROTHERMAL MODELLING OF MASONRY WALLS ACCOUNTING FOR IMPERFECTIONS AT THE MASONRY JOINT	507
<i>Gulland Michael, Bucking Scott, Santana Quintero Mario</i>	
COMPARISON OF HYGROTHERMAL 2D- AND 3D-SIMULATION RESULTS WITH MEASUREMENTS FROM A TEST HOUSE.....	514
<i>Ruisinger Ulrich, Kautsch Peter</i>	
A NEW METHOD TO ESTIMATE POINT THERMAL TRANSMITTANCE BASED ON COMBINED TWO-DIMENSIONAL HEAT FLOW CALCULATION.....	521
<i>Hallik Jaanus, Kalamees Targo</i>	
PCSP'S DIAGONAL TIE CONNECTORS THERMAL BRIDGES IMPACT ON ENERGY PERFORMANCE AND OPERATIONAL COST: CASE STUDY OF A HIGH-RISE RESIDENTIAL BUILDING IN ESTONIA.....	529
<i>Kiil Martin, Kaarid Martin-Sven, Kloseiko Paul, Vosa Karl-Villem, Simson Raimo, Sarevet Henri, Thalfeldt Martin, Kurnitski Jarek</i>	
STOCHASTIC FINITE ELEMENT METHOD FOR MODELLING HEAT TRANSFER IN THE BUILDING ENVELOPE	537
<i>Grymin Witold, Koniorczyk Marcin</i>	
THE INFLUENCE OF POLYISOCYANURATE (PIR) FACING ON THE HEAT TRANSFER THROUGH THE CORNERS OF INSULATED BUILDING PARTITIONS.....	543
<i>Makaveckas Tomas, Bludzius Raimondas</i>	

THREE-DIMENSIONAL UNSTEADY ENERGY SIMULATION OF BUILDING ENVELOPES COMPOSED OF HOLLOW CONCRETE BLOCKS	549
<i>Cherem-Pereira Gustavo, Mendes Nathan, Mazuroski Walter</i>	
EVALUATION OF THERMAL BRIDGES USING ONLINE SIMULATION SOFTWARE.....	558
<i>Moga Ligia, Moga Ioan</i>	
EFFECTIVENESS OF FIXED-BED REGENERATORS FOR ENERGY RECOVERY IN BUILDINGS APPLICATIONS	566
<i>Ramin Hadi, Krishnan Easwaran N., Simonson Carey J.</i>	
ACCEPTABLE AIR VELOCITIES USING DEMAND-CONTROLLED VENTILATION FOR INDIVIDUAL COOLING	574
<i>Thunshelle Kari, Nordby Henrik S., Rikoll Solberg Hakon, Holos Sverre, Schild Peter G.</i>	
IMPACT OF HIGH RESIDENTIAL DENSITY ON THE BUILDING TECHNOLOGY, HVAC SYSTEMS, AND INDOOR ENVIRONMENT IN SWEDISH APARTMENTS.....	581
<i>Abdul Hamid Akram, Von Platten Jenny, Mjornell Kristina, Johansson Dennis, Bagge Hans</i>	

PART 2

ANALYSIS OF ALTERNATIVE VENTILATION STRATEGIES FOR EXISTING MULTI- FAMILY BUILDINGS USING CONTAM SIMULATION SOFTWARE.....	589
<i>Tian Xinxiu, Fine Jamie, Touchie Marianne</i>	
ANALYSIS OF WIND SPEED AND WIND PRESSURE ON THE FACADES IN FREQUENCY DOMAIN FOR THE MODELLING OF AIR CHANGE RATE.....	597
<i>Pietrzyk Krystyna</i>	
IMPACT OF TYPICAL FAULTS OCCURRING IN DEMAND-CONTROLLED VENTILATION ON ENERGY AND INDOOR ENVIRONMENT IN A NORDIC CLIMATE.....	603
<i>Heimar Andersen Kamilla, Holos Sverre B., Yang Aileen, Thunshelle Kari, Fjellheim Oystein, Lund Jensen Rasmus</i>	
CURTAIN WALL WITH SOLAR PREHEATING OF VENTILATION AIR. FULL SCALE EXPERIMENTAL ASSESSMENT	611
<i>Garay-Martinez Roberto, Arregi Benat</i>	
DESIGN CRITERIA FOR OUTDOOR AIR INTAKES AND EXHAUST AIR OUTLETS LOCATED ON AN EXTERNAL WALL	616
<i>Palmiste Ülar, Kurnitski Jarek, Voll Hendrik</i>	
ENERGY SAVING POTENTIAL WITH SMART THERMOSTATS IN LOW-ENERGY HOMES IN COLD CLIMATE	624
<i>Kull Tuule Mall, Penu Karl-Rihard, Thalfeldt Martin, Kurnitski Jarek</i>	
ANALYSIS OF NATURAL VENTILATION PERFORMANCE GAP BETWEEN DESIGN STAGE AND ACTUAL OPERATION OF OFFICE BUILDINGS.....	631
<i>Fu Xiuzhang, Han Mingzhu</i>	
MOISTURE SAFETY IN CLT CONSTRUCTION WITHOUT WEATHER PROTECTION – CASE STUDIES, LITERATURE REVIEW AND INTERVIEWS.....	637
<i>Olsson Lars</i>	

IDENTIFICATION AND IMPROVEMENT OF CRITICAL JOINTS IN CLT CONSTRUCTION WITHOUT WEATHER PROTECTION	645
<i>Kalbe Kristo, Kuk Villu, Kalamees Targo</i>	
WETTING AND DRYING PERFORMANCE OF CROSS-LAMINATED TIMBER RELATED TO ON-SITE MOISTURE PROTECTIONS: FIELD MEASUREMENTS AND HYGROTHERMAL SIMULATIONS.....	653
<i>Wang Lin, Wang Jieying, Ge Hua</i>	
NUMERICAL AND REAL-LIFE ASSESSMENT OF THE MOISTURE SAFETY OF CLT STRUCTURE WITH PIR INSULATION COMPOSITE UNDER THE SWEDISH CLIMATE	660
<i>Goto Yutaka, Wallbaum Holger, Olofsson Johan, Norr Ulf</i>	
METHODS FOR CREATING CLT CONSTRUCTION GUIDELINES	668
<i>Wahlstrom Simen</i>	
INVESTIGATING THE PRESENCE OF MOLD IN WOOD TREATED WITH CHLOROPHENOL.....	675
<i>Ekberg Olle, Lorentzen Johnny C., Harderup Lars-Erik</i>	
RELYING ON REFERENCE CASES WHEN EVALUATING NEW TECHNICAL SOLUTIONS? EVALUATION OF TECHNICAL DOCUMENTATION IN A CASE STUDY	680
<i>Svensson Tengberg Charlotte, Hagentoft Carl-Eric</i>	
EXPERIENCES WITH CLT CONSTRUCTION IN NORWAY.....	688
<i>Wahlstrom Simen, Gullbrekken Lars, Elvebakk Kristin, Kvande Tore</i>	
HYGROTHERMAL CONDITIONS IN CROSS LAMINATED TIMBER (CLT) DWELLINGS.....	696
<i>Solvang Tingstveit Merethe, Kofoed Nielsen Henrik, Risholt Birgit</i>	
MOISTURE HANDLING MECHANISMS IN ICE RINKS.....	703
<i>Pomerancevs Juris, Rogstam Jorgen, Lickrastina Agnese</i>	
ACHIEVING AIRTIGHTNESS AND WEATHER PROTECTION OF CLT BUILDINGS.....	711
<i>Herms Jens-Lüder</i>	
MICROCLIMATE ENVIRONMENTAL ASSESSMENT AND IMPACT OF MOUNTAIN CITY PEDESTRIAN STREETS IN SUMMER	714
<i>Xiong Ke, Yang Zhenjing, Cheng Canhua</i>	
MODELS FOR RESIDENTIAL INDOOR POLLUTION LOADS DUE TO MATERIAL EMISSIONS UNDER DYNAMIC TEMPERATURE AND HUMIDITY CONDITIONS.....	720
<i>Rode Carsten, Grunewald John, Liu Zhenlei, Qin Menghao, Zhang Jianshun</i>	
CLIMATE DATA ANALYSIS TO ASSESS RESILIENCE OF WALL ASSEMBLIES TO MOISTURE LOADS ARISING FROM THE EFFECTS OF WIND-DRIVEN RAIN.....	728
<i>Xiao Zhe, Lacasse Michael A., Gaur A., Dragomirescu Elena</i>	
PRESSURE DISTRIBUTION AROUND THE THERMAL ENVELOPE - A PARAMETRIC STUDY OF THE IMPACT FROM WIND AND TEMPERATURE ON CONTAMINANT TRANSPORT WITHIN A BUILDING	733
<i>Domhagen Fredrik, Wahlgren Paula, Hagentoft Carl-Eric</i>	
DEVELOPMENT OF A STATISTICAL MODEL TO ASSESS THE CLIMATE CONDITIONS IN THE VENTILATION LAYER OF DOUBLE PITCHED ROOFS	740
<i>Tieben Johannes, Bachinger Julia, Nusser Bernd</i>	

PREDICTING SOLAR RADIATION USING A PARAMETRIC CLOUD MODEL	750
<i>Skeie Kristian, Gustavsen Arild</i>	
DESIGN OF A CALORIMETRIC TEST FACILITY TO REPLICATE REAL BOUNDARY CONDITIONS IN THE GULF COUNTRIES	758
<i>Garay-Martinez Roberto, Jayan Bejay, Arregi Benat</i>	
PRELIMINARY RESULTS OF INDOOR MOISTURE EXCESS MEASUREMENTS FOR RESIDENTIAL AND OFFICE BUILDINGS IN LATVIA	764
<i>Zemitis Jurgis, Bogdanovics Raimonds</i>	
UTILIZATION PLASTERS WITH SUPERABSORBENT ADMIXTURE TO MODERATE MOISTURE LEVEL IN CONSTRUCTIONS	770
<i>Foot Jan, Hotik Petr, Koei Jan, Eerný Robert</i>	
EVALUATING THE PRACTICABILITY OF THE NEW URBAN CLIMATE MODEL PALM- 4U USING A LIVING-LAB APPROACH	776
<i>Winkler Matthias, Steuri Bettina, Stalder Sebastian, Antretter Florian</i>	
EXPERIMENTAL VALIDATION OF A MODEL-BASED METHOD FOR SEPARATING THE SPACE HEATING AND DOMESTIC HOT WATER COMPONENTS FROM SMART-METER CONSUMPTION DATA	784
<i>Hedegaard Rasmus Elbaek, Kristensen Martin Heine, Petersen Steffen</i>	
ANALYSIS OF MONTHLY AND DAILY PROFILES OF DHW USE IN APARTMENT BLOCKS IN NORWAY	792
<i>Ivanko Dmytro, Taxt Walnum Harald, Lekang Sorensen Ase, Nord Natasa</i>	
PERFORMANCE ANALYSIS OF GLAZED PVT COLLECTORS FOR MULTIFAMILY BUILDING	799
<i>Pokorny Nikola, Matuska Tomas</i>	
TREATMENT AND ANALYSIS OF SMART ENERGY METER DATA FROM A CLUSTER OF BUILDINGS CONNECTED TO DISTRICT HEATING: A DANISH CASE	804
<i>Johra Hicham, Leiria Daniel, Heiselberg Per, Marszal-Pomianowska Anna, Tvedebrink Torben</i>	
THE INFLUENCE OF HEAT LOSS FROM PIPES IN AN UNHEATED BASEMENT ON THE HEATING ENERGY CONSUMPTION OF AN ENTIRE TYPICAL APARTMENT BUILDING	812
<i>Hamburg Anti, Kalamees Targo</i>	
DESIGN AND SIMULATION OF A NEW PCM HEAT EXCHANGER FOR DOMESTIC HOT WATER AND AIR TEMPERATURE CONTROL	820
<i>Robadey Jacques, Rime Simon, Voide Dominique</i>	
MODELLING MULTI-LAYER HYDRONIC RADIATORS	825
<i>Chen Ligu, Sorensen Bjorn Reidar</i>	
RESIDENTIAL BUILDINGS WITH HEAT PUMPS PEAK POWER REDUCTION WITH HIGH PERFORMANCE INSULATION	832
<i>Sarevet Henri, Fadejev Jevgeni, Thalfeldt Martin, Kurnitski Jarek</i>	
MAPPING OF DOMESTIC HOT WATER CIRCULATION LOSSES IN BUILDINGS – PRELIMINARY RESULTS FROM 134 MEASUREMENTS	837
<i>Burke Stephen, Von Seth Jonatan, Ekstrom Tomas, Maljanovski Christoffer, Wiktorsson Magnus</i>	

ENERGY FLEXIBILITY ASSESSMENT OF A ZONE WITH RADIANT FLOOR HEATING SYSTEM BY MEANS OF EXPERIMENTAL MEASUREMENTS	843
<i>Saberi Derakhtenjani Ali, Athienitis Andreas</i>	
GLAZED BALCONIES AND THEIR INFLUENCE ON THE TEMPERATURE REDUCTION FACTOR DURING THE HEATING SEASON	848
<i>Grudzinska Magdalena</i>	
INTEGRATION OF PIPE MODELS IN DELPHIN AND NANDRAD	856
<i>Weiß Dirk, Tribulowski Katja, Hirth Stephan, Fechner Heiko</i>	
KOUVOLA HOUSING FAIR NZEB HOUSES ENERGY, COST AND CARBON ANALYSES	863
<i>Ahmed Kaiser, Hajian Hatef, Hasu Tero, Kurnitski Jarek</i>	
COST REDUCTION OF THE NEW NZEB WOODEN BUILDING – CASE STUDY OF THE KINDERGARTEN IN ESTONIA.....	871
<i>Arumagi Endrik, Kalamees Targo</i>	
IMPLEMENTATION OF A METHOD FOR CONVERTING SOIL PROPERTIES INTO BUILDING PHYSICAL MATERIAL PROPERTIES	879
<i>John Grunewald, Hauke Hirsch, Hans Petzold</i>	
HOW EFFECTIVE IS KAOLIN CLAY FOR THE CREATION OF A PERFECT HYDRAULIC INTERFACE CONTACT BETWEEN MATERIALS?.....	887
<i>Vereecken Evy, Schutová Petra, Roels Staf</i>	
ON THE IMPORTANCE OF DESICCANT DURING THE DETERMINATION OF WATER VAPOR PERMEABILITY OF PERMEABLE INSULATION MATERIAL	894
<i>Colinart Thibaut, Glouannec Patrick</i>	
MODIFIED PRESSURE PLATE METHOD FOR MEASURING ADSORPTION MOISTURE RETENTION CURVES	901
<i>Feng Chi, Janssen Hans</i>	
THE TIN CAN METHOD FOR DETERMINING MOISTURE TRANSPORT PROPERTIES OF CONCRETE.....	906
<i>Nilsson Lars-Olof, Bergstrom Kent</i>	
INTERNAL HYDROPHOBIZATION OF CEMENTITIOUS MATERIALS BY USING OF ORGANOSILICON COMPOUNDS	913
<i>Grabowska Kalina Barbara, Konioreczyk Marcin</i>	
WATER MIGRATION IN WOOD DURING IMBIBITION ASSESSED BY X-RAY IMAGING.....	921
<i>Martin Benoît, Colin Julien, Lu Pin, Mounkaila Mahamadou, Casalinho Joel, Perré Patrick, Rémond Romain</i>	
NOVEL ACTIVE METHOD FOR THE ESTIMATION OF A BUILDING WALL THERMAL RESISTANCE.....	928
<i>François Adrien, Ibos Laurent, Feuillet Vincent, Meulemans Johann</i>	
MEASUREMENTS OF THERMAL TRANSMITTANCE OF AN EXTERNAL MASSIVE TIMBER WALL IN-SITU AND IN THE LABORATORY	936
<i>Geyer Christoph, Müller Andreas, Wehle Barbara</i>	
HYGROTHERMAL PERFORMANCE OF PAPER PLASTER: INFLUENCE OF DIFFERENT TYPES OF PAPER AND PRODUCTION METHODS ON MOISTURE BUFFERING	941
<i>Soolepp Mihkel, Ruus Aime, Nutt Nele, Raamets Jane, Kubjas Ardo</i>	

EFFECT OF SUPERABSORBENT POLYMER ADMIXTURES ON HYGRIC AND THERMAL PROPERTIES OF CEMENT MORTAR	947
<i>Foot Jan, Hotik Petr, Mildner Martin, Krejsová Jitka, Eerný Robert</i>	
DAMAGE RISK ASSESSMENT IN HISTORIC BUILDINGS USING EQUIVALENT WALL-PARTS	953
<i>Widstrom Torun</i>	
ANALYSIS OF CAUSES OF THE END OF SERVICE LIFE OF A SPRAY POLYURETHANE FOAM AND POLYUREA ROOF	961
<i>Kalamees Targo, Ilomets Simo, Poldaru Mattias, Kloiseiko Paul, Kallavus Urve, Rosenberg Margit, Oiger Karl</i>	
CLIMATE ADAPTATION OF LISTED BUILDINGS: AN INTERACTION BETWEEN DESIGN, REGULATIONS AND ENERGY EFFICIENCY	967
<i>Karasu Arda, Hantouch Yaser, Steffan Claus</i>	
HUMIDITY CHANGE RATE CONTROL IN INTERMITTENTLY HEATED HISTORIC BUILDINGS	973
<i>Wessberg Magnus, Vyhlidal Tomás, Brostrom Tor</i>	
STUDY OF THE CONSERVATION AND EXHIBITION OF BURNED WALL PAINTINGS IN THE MAIN HALL OF THE TREASURE HOUSE AT HORYU-JI TEMPLE	979
<i>Wada Takuya, Ogura Daisuke, Sano Chie, Hokoi Shuichi, Iba Chiemi</i>	
HYGROTHERMAL PERFORMANCE OF LOG WALLS IN A BUILDING OF 18TH CENTURY AND PREDICTION OF CLIMATE CHANGE IMPACT ON BIOLOGICAL DETERIORATION	987
<i>Choidis Petros, Tsikaloudaki Katerina, Kraniotis Dimitrios</i>	
DYNAMIC HYGROTHERMAL MODELS FOR MONUMENTAL, HISTORIC BUILDINGS WITH HVAC SYSTEMS: COMPLEXITY SHOWN THROUGH A CASE STUDY	995
<i>Posani Magda, Veiga Maria Do Rosario, Peixoto De Freitas Vasco, Kompatscher Karin, Schellen Henk</i>	
ATTIC CONVERSION – HYGROTHERMAL ASSESSMENT OF HISTORICAL ROOF TRUSS	1004
<i>Sojkova Katerina, Stanek Kamil</i>	
SURVEY ON THERMAL ENVIRONMENTS IN BATHROOMS AND ELDERLY BEHAVIOR WHILE BATHING IN OLD RESIDENTIAL BUILDINGS IN NANJING, CHINA	1011
<i>Shi Pengcheng, Li Yonghui, Ying Yuan, Hokoi Shuichi</i>	
PREDICTION OF VENTILATION EFFECTS ON REDUCING MOISTURE DAMAGE IN TISHUN TANG IN THE PALACE MUSEUM IN BEIJING, CHINA	1019
<i>Ma Yan, Li Yonghui, Hokoi Shuichi, Zhang Xiaogu</i>	
IMPACT OF URBAN DENSIFICATION ON BUILDING ENERGY CONSUMPTION	1026
<i>Liu Dalong, Wang Wenqin, Ge Hua</i>	
GREEN BUILDINGS IN THE ARCTIC REGION: A LITERATURE REVIEW	1032
<i>Ravasio Lucrezia, Riise Raymond, Sveen Svein Erik</i>	
ENERGY PERFORMANCE ASSESSMENT AND OPTIMIZATION OF EXTENSIVE GREEN ROOFS IN DIFFERENT CLIMATE ZONES OF CHINA	1040
<i>Ran Jiandong, Yang Zhenjing, Feng Ya, Xiong Ke, Tang Mingfang</i>	

OPTIMUM ENVELOPE DESIGN TOWARD ZERO ENERGY BUILDINGS IN IRAN	1047
<i>Ramin Hadi, Karimi Hazhir</i>	
CONTRASTING DEFINITIONS OF HIGH ENERGY PERFORMANCE BUILDINGS	1055
<i>Verhaeghe Charlotte, Amaryllis Audenaert, Verbeke Stijn</i>	
MARKET REVIEW OVER THE ENERGY POLICIES THAT STIMULATE, ENCOURAGE AND ADOPT BUILDING CODES FOR NZEB PROMOTION: THE US AND THE EUROPEAN CASE.....	1065
<i>Moga Ligia, Maghiar Marcel</i>	
A STUDY OF SOLAR PANEL EFFICIENCY IN LATVIAN CLIMATE CONDITIONS	1073
<i>Telicko Jevgenijs, Heincis Daniels, Jakovics Andris</i>	
UNDERGROUND PARKING LOT AT TURKU MARKET SQUARE - ZERO ENERGY PARKING HALL AND THE BIGGEST SOLAR ENERGY STORAGE IN THE WORLD.....	1077
<i>Lautkankare Rauli, Salomaa Nikolas, Martinkauppi Birgitta, Slobodenyuk Anna</i>	
MERGING GEO-SOLAR EXERGY STORAGE TECHNOLOGY (GEST) AND ENVIRONMENTAL QUALITY MANAGEMENT (EQM): A PRACTICAL SOLUTION FOR NZEB RETROFIT	1085
<i>Lingo Lowell, Lingo Kristin, Bomberg Mark</i>	
INFLUENCE OF OCCUPANT BEHAVIOUR ON THE STATE OF CHARGE OF A STORAGE BATTERY IN A NEARLY-ZERO ENERGY BUILDING	1093
<i>Pereira Pedro F., Ramos Nuno M. M.</i>	
ACHIEVING ENERGY AND RESOURCE OPTIMISATION WITHIN URBAN MIXED USE DEVELOPMENTS UTILISING PASSIVHAUS PREMIUM DESIGN STRATEGIES	1099
<i>Murray Martin</i>	
MEASURED AND SIMULATED ENERGY PERFORMANCE OF OLK NZEB WITH HEAT PUMP AND ENERGY PILES IN HÄMEENLINNA	1106
<i>Fadejev Jevgeni, Simson Raimo, Kesti Jyrki, Kurnitski Jarek</i>	
TIME DOMAIN REFLECTOMETRY (TDR) TECHNIQUE – A SOLUTION TO MONITOR MOISTURE CONTENT IN CONSTRUCTION MATERIALS	1117
<i>Stingl Freitas Teresa, Sofia Guimaraes Ana, Roels Staf, Peixoto De Freitas Vasco, Cataldo Andrea</i>	
EXPERIMENTAL INVESTIGATION OF THE DRYING BEHAVIOUR OF THE BUILDING MATERIALS	1125
<i>Zhao Jianhua, Meissener Frank, Grunewald John, Feng Shuo</i>	
CAPILLARY CONDENSATION EXPERIMENT FOR INVERSE MODELLING OF POROUS BUILDING MATERIALS	1132
<i>Hirsch Hauke, Heyn Rüdiger, Kloseiko Paul</i>	
UNCERTAINTY AND SENSITIVITY ANALYSIS APPLIED TO A RAMMED EARTH WALL: EVALUATION OF THE DISCREPANCIES BETWEEN EXPERIMENTAL AND NUMERICAL DATA.....	1139
<i>Bui Rudy, Goffart Jeanne, McGregor Fionn, Woloszyn Monika, Fabbri Antonin, Grillet Anne- Cécile</i>	
WATER VAPOR SORPTION DYNAMICS IN DIFFERENT COMPRESSIONS OF EELGRASS INSULATION.....	1146
<i>Frandsen Kirstine Meyer, Antonov Yovko Ivanov, Moldrup Per, Jensen Rasmus Lund</i>	

LABORATORY TESTS AND MODELLING OF MINERAL WOOL INSULATED STEEL SANDWICH PANELS	1153
<i>Laukkarinen Anssi, Vinha Juha, Kalbe Kristo, Kesti Jyrki, Kalamees Targo, Honkakoski Erkki</i>	
MOISTURE DRY-OUT FROM STEEL FACED INSULATED SANDWICH PANELS	1161
<i>Kalbe Kristo, Piikov Hubert, Kesti Jyrki, Honkakoski Erkki, Kurnitski Jarek, Kalamees Targo</i>	
THERMAL ANALYSIS OF WATER CONFINED IN FULLY AND PARTIALLY SATURATED CEMENT PASTE	1169
<i>Bednarska Dalia, Koniorczyk Marcin</i>	

PART 3

ESTABLISHING MATERIAL HYGROTHERMAL CHARACTERISTICS VIA LONG-TERM MONITORING AND BEST-FIT NUMERICAL MODELS	1175
<i>Birjukovs Mihails, Apine Inga, Jakovics Andris</i>	
ELECTROOSMOSIS – A METHOD APPLIED FOR HANDLING OF MOISTURE IN FOUNDATIONS.....	1181
<i>Bjork Folke, Sederholm Bror, Tragardh Jan, Olofsson Bo</i>	
DEVELOPMENT OF PREFABRICATED INSULATION ELEMENTS FOR BUILDINGS WITH AERATED AUTOCLAVED CONCRETE WALLS.....	1186
<i>Pihelo Peep, Kalamees Targo</i>	
THE TRADE-OFF BETWEEN DEEP ENERGY RETROFIT AND IMPROVING BUILDING INTELLIGENCE IN A UNIVERSITY BUILDING	1194
<i>Jradi Muhyiddine</i>	
ENVIRONMENTAL EVALUATION OF PARETO OPTIMAL RENOVATION STRATEGIES: A MULTIDIMENSIONAL LIFE-CYCLE ANALYSIS	1202
<i>Decorte Yanaika, Steeman Marijke, Van Den Bossche Nathan, Calle Klaas</i>	
PRELIMINARY ASSESSMENT OF PRECONDITIONS TO DELIVER CARBON NEUTRALITY IN APARTMENT BUILDINGS BY 2050	1210
<i>Lihtmaa Lauri, Kalamees Targo</i>	
COMPARISON OF AN LCA AND LCC FOR FAÇADE RENOVATION STRATEGIES DESIGNED FOR CHANGE.....	1216
<i>Van Gulck Lisa, Van De Putte Stijn, Van Den Bossche Nathan, Steeman Marijke</i>	
DRIVING DECARBONISATION OF THE EU BUILDING STOCK BY ENHANCING A CONSUMER CENTRED AND LOCALLY BASED CIRCULAR RENOVATION PROCESS	1225
<i>Tisov Ana, Kuusk Kalle, Navarro Escudero Miriam, Niki Assimakopoulos Margarita, Papadaki Dimitra, Pihelo Peep, Op 't Veld Peter, Kalamees Targo</i>	
STRATEGIES FOR SCHOOL BUILDINGS REFURBISHMENT IN PORTUGUESE CLIMATE	1232
<i>Cavaleiro Barbosa Francisca, Peixoto De Freitas Vasco, Almeida Manuela</i>	
A TOOL FOR DANISH BUILDINGS ENERGY RETROFIT DESIGN AND EVALUATION USING DYNAMIC ENERGY SIMULATIONS.....	1239
<i>Jradi Muhyiddine, Engelbrecht Foldager Henrik, Camillus Jeppesen Rasmus</i>	
NEARLY ZERO ENERGY RENOVATION CONCEPTS FOR APARTMENT BUILDINGS.....	1247
<i>Kuusk Kalle, Naumann Jens, Gritzki Annina, Felsmann Clemens, De Carli Michele, Tonon Massimo, Kurnitski Jarek</i>	

SOLUTIONS FOR RETROFITTING EXISTING, WOODEN HOUSES IN COLD CLIMATES	1254
<i>Hrynyszyn Bozena Dorota, Tian Zhiyong</i>	
COMPARISON AND DEVELOPMENT OF DAYLIGHT SIMULATION SOFTWARE – A CASE STUDY	1262
<i>Solvang Helene, Kristiansen Tobias, Bottheim Ruth Marie, Kampel Wolfgang</i>	
OPTIMIZATION OF BUILDING FORM AND ITS FENESTRATION IN RESPONSE TO MICROCLIMATE CONDITIONS OF AN URBAN AREA	1269
<i>Javanroodi Kavan, Nik Vahid M., Yang Yuchen</i>	
THE USE OF SOLAR SHADING IN A NEARLY ZERO-ENERGY NEIGHBOURHOOD	1277
<i>Verbruggen Silke, Hertoge Jolien, Delghust Marc, Laverge Jelle, Janssens Arnold</i>	
CURRENT BUILDING STRATEGIES IN GREENLAND	1283
<i>Moller Eva B., Lading Tove</i>	
THE 3D PRINTING CHALLENGE IN BUILDINGS	1291
<i>Pessoa Sofia, Guimaraes Ana Sofia</i>	
MODULAR STATISTICAL SYSTEM FOR AN INTEGRATED ENVIRONMENTAL CONTROL	1298
<i>Romanska-Zapala Anna, Dudek Piotr, Górny Mariusz, Dudzik Marek</i>	
THE EFFECT OF PCM LAYER ON THE NATURAL AIR FLOW MOVEMENT IN THE FAÇADE CAVITY OF BIPV SYSTEM	1304
<i>Eurpek Jakub, Eekon Miroslav</i>	
DESIGN OF AN ADVANCED HOT BOX-COLD BOX WITH FULL CLIMATIC CONTROL TO TEST HEAT, AIR AND MOISTURE TRANSPORT THROUGH REAL SCALE BUILDING ELEMENTS	1312
<i>Daems David, Tilmans Antoine, De Mets Timo, Loncour Xavier</i>	
COMPARATIVE ANALYSIS OF SELECTED GLASS SYSTEMS BY DYNAMIC SIMULATION USING MEASURED REAL ENVIRONMENTAL CONDITIONS	1316
<i>Bizoòová Silvia, Katunský Dusan, Bagoða Miloslav</i>	
ENERGY SAVING ARCHITECTURE: BACKGROUND, THEORY AND PRACTICE IN KYRGYZSTAN	1323
<i>Boronbaev Erkin</i>	
THE VENTILATED BUILDING SYSTEM	1331
<i>Wasenius Birger E.</i>	
PREDICTING MOULD GROWTH ON BUILDING MATERIALS- THE PJ-MODEL	1337
<i>Johansson Pernilla, Svensson Thomas</i>	
THRESHOLD VALUES FOR MOULD GROWTH: CRITICAL MOISTURE LEVEL OF 21 DIFFERENT BUILDING MATERIALS.....	1343
<i>Johansson Pernilla, Lang Lukas, Bok Gunilla, Capener Carl-Magnus</i>	
MICROBIAL GROWTH BEHIND TILES IN BATHROOMS	1349
<i>Bok Gunilla, Johansson Pernilla</i>	

MONITORED CONDITIONS IN WOODEN WALL PLATES IN RELATION TO MOLD AND WOOD DECAYING FUNGI.....	1353
<i>Kvist Hansen Tessa, Feldt Jensen Nickolaj, Moller Eva, Jan De Place Hansen Ernst, Peuhkuri Ruut</i>	
INVESTIGATION OF THE MOULD RESISTANCE DESIGN (MRD) MODEL FOR MOULD GROWTH IN ATTICS	1361
<i>Hansen Thor, Wallentén Petter</i>	
CLIMATE CHANGE IMPACTS AND FUNGAL DECAY IN VULNERABLE HISTORIC STRUCTURES AT SVALBARD.....	1365
<i>Flyen Anne-Cathrine, Flyen Cecilie, Mattsson Johan</i>	
MINISTRY OF THE ENVIRONMENT ANNOUNCES A GUIDE ON RENOVATION AND REPAIR OF BUILDINGS WITH MOISTURE AND MICROBIAL DAMAGE – FROM THEORY TO PRACTICE	1373
<i>Weijo Inari, Turunen Timo, Lahdensivu Jukka, Sistonen Esko, Annila Petri</i>	
INVESTIGATION ON THE DETERIORATION MECHANISM OF TUFF STONES USED FOR THE EXTERIORS AT THE FORMER KOSHIEH HOTEL.....	1379
<i>Yamada Koki, Iba Chiemi, Uno Tomoko, Fukui Kazuma, Ogura Daisuke</i>	
ASSESSMENT OF INTERSTITIAL MOULD GROWTH THROUGH IMPACTION: A FEASIBILITY STUDY.....	1386
<i>Efthymiopoulos Spyridon, Altamirano Hector, Marincioni Valentina</i>	
PERFORMANCE OF WOOD AND WOOD-BASED MATERIALS REGARDING FUNGAL DECAY	1394
<i>Vanpachtenbeke Michiel, Van Den Bulcke Jan, Van Acker Joris, Roels Staf</i>	
STUDY ON THE TEMPERATURE DEPENDENCE OF GAS PERMEATION AND ADSORPTION BEHAVIOR OF THE VACUUM INSULATION PANEL WITH GETTER MATERIALS	1402
<i>Yamamoto Hideya, Ogura Daisuke</i>	
INFLUENCE OF PHASE CHANGE MATERIALS (PCMS) ON THE THERMAL PERFORMANCE OF BUILDING ENVELOPES.....	1409
<i>Zhou Hongxia, Fransson Ake, Olofsson Thomas</i>	
SOLAR REFLECTANCE OF ETICS FINISHING COATINGS – A COMPARISON OF EXPERIMENTAL TECHNIQUES	1417
<i>Ramos Nuno M. M., Souza Andrea R., Maia Joana, Almeida Ricardo M. S. F.</i>	
THE INTEGRATION OF SELECTED TECHNOLOGY TO ENERGY ACTIVATED ETICS - THEORETICAL APPROACH	1424
<i>Heim Dariusz, Chodak Ivan, Ilomets Simo, Knera Dominika, Wieprzkowicz Anna, Kalamees Targo</i>	
NEW AEROGEL PRODUCTS FOR CONSTRUCTION USE: PRODUCT SPECIFICATIONS, APPLICATION EXAMPLES, PRACTICAL ASPECTS.....	1431
<i>Günther Eva, Fricke Marc, Lolsberg Wibke, Klinkebiel Arne, Weinrich Dirk</i>	
A METHOD TO DEVELOP ENERGY ACTIVATED ETICS.....	1437
<i>Ilomets Simo, Heim Dariusz, Chodak Ivan, Czarny Dariusz, Kalamees Targo</i>	

THERMAL CONDUCTIVITY OF SILICA-AEROGEL (SA) AND AUTOCLAVE AERATED CONCRETE (AAC) COMPOSITES	1445
<i>Mingliang Qu, Shuaiqi Tian, Liwu Fan, Zitao Yu, Jian Ge</i>	
RISK-BASED OPTIMIZATION OF SENSOR DISTRIBUTION IN ROOF CONSTRUCTIONS – A CONCEPTUAL STUDY	1450
<i>Gradeci Klodian, Time Berit, Gullbrekken Lars</i>	
CASE STUDY – WHEN A ROOF IS MORE THAN A ROOF	1456
<i>Hutchinson Thomas W.</i>	
EXPERIENCES WITH EXTERNAL DRAINAGE SYSTEMS FROM COMPACT ROOFS IN NORWEGIAN CLIMATES.....	1461
<i>Andenaes Erlend, Skagseth Vegard A., Bunkholt Nora S., Kvande Tore, Lohne Jardar</i>	
IDENTIFYING FAULTS IN THE BUILDING SYSTEM BASED ON MODEL PREDICTION AND RESIDUUM ANALYSIS	1468
<i>Parzinger Michael, Wellisch Ulrich, Hanfstaengl Lucia, Sigg Ferdinand, Wirnsberger Markus, Spindler Uli</i>	
THE DEVELOPMENT OF AN RC-NETWORK SIMULATION MODEL CALIBRATED WITH MONITORING DATA FOR USE IN THE PERFORMANCE GUARANTEE OF NET-ZERO HOUSES	1475
<i>Spiekman Marleen, Vijlbrief Olav, Tahir Haseeb, Bulut Yasin, Borsboom Wouter, Van Goch T. A. J., Van Ginkel Dick, Van Kessel Edwin</i>	
WHOLE BUILDING VALIDATION FOR SIMULATION PROGRAMS INCLUDING SYNTHETIC USERS AND HEATING SYSTEMS: EXPERIMENTAL DESIGN	1481
<i>Kersken Matthias, Strachan Paul, Mantesi Eirini, Flett Graeme</i>	
ASSESSING THE BUILDING ENVELOPE PERFORMANCE DURING OCCUPANCY	1490
<i>Deltour Jade, Heijmans Nicolas, De Sloover Karel</i>	
IDENTIFYING OCCUPANT PRESENCE IN A ROOM BASED ON MACHINE LEARNING TECHNIQUES BY MEASURING INDOOR AIR CONDITIONS	1499
<i>Hanfstaengl Lucia, Parzinger Michael, Spindler Uli, Wellisch Ulrich, Wirnsberger Markus</i>	
DETAILED MONITORING AS AN ESSENTIAL TOOL FOR ACHIEVING ENERGY PERFORMANCE TARGETS IN OPERATION CONDITIONS: THE HIKARI CASE STUDY.....	1507
<i>Guyot Dimitri, Giraud Florine, Simon Florian, Corgier David, Marvillet Christophe, Tremeac Brice</i>	
COMPARISON OF THE ACTUAL AND THEORETICAL ENERGY USE IN NZEB RENOVATIONS OF MULTI-FAMILY BUILDINGS USING IN SITU MONITORING	1513
<i>Van De Putte Stijn, Bracke Wolf, Delghust Marc, Steeman Marijke, Janssens Arnold</i>	
TRANSITION TOWARDS AN ENERGY-EFFICIENT SCIENTIFIC OFFICE SETUP IN AUSTRIA’S LARGEST (PLUS-)PLUS-ENERGY OFFICE BUILDING – AN ANALYSIS	1521
<i>David Alexander, Bednar Thomas</i>	
MONITORING AND CONTINUOUS COMMISSIONING OF NEW AND EXISTING BUILDINGS	1529
<i>Olli Terio, Ilkka Raina, Markku Hienonen, Hannu Kaariainen, Timo Kauppinen</i>	
STUDY OF HEAT LOSS: RAMIRENT RENTAL MODULES.....	1535
<i>Edula Kristjan</i>	

PERFORMANCE ANALYSIS OF SOLAR ASSISTED GROUND COUPLED HEAT PUMP SYSTEM IN LATVIA	1539
<i>Migla Lana, Snegirjovs Andrejs, Shutenkova Olga</i>	
BENEFITS OF INVESTIGATING THE THERMAL COMPONENT FOR MOISTURE SAFETY IN VENTILATED ATTICS	1544
<i>Claesson Johan, Wallentén Petter</i>	
COMPREHENSIVE ASSESSMENT BRINGS OUT SHORTCOMINGS IN ALMOST EVERY SCHOOL BUILDING	1550
<i>Marttila Tero, Lahdensivu Jukka, Pekkanen Juha</i>	
TOWARDS MOISTURE SAFE VENTILATED COLD ATTICS – MONITORED CONDITIONS IN A FULL-SCALE TEST BUILDING	1558
<i>Hansen Thor, Moller Eva, Peuhkuri Ruut</i>	
RELIABILITY OF THE DETECTION OF MOISTURE AND MOULD DAMAGE IN VISUAL INSPECTIONS	1565
<i>Annala Petri J., Lahdensivu Jukka</i>	
DETERIORATION IN BRICK BUILDINGS: HYGROTHERMAL PERFORMANCE AND MEASURES TO SAVE THEM.....	1572
<i>Johansson Par, Wahlgren Paula</i>	
THERMAL BEHAVIOUR AND WEATHERING RESISTANCE OF COIL COATINGS FOR ENERGY-EFFICIENT BUILDINGS	1579
<i>Rossi Stefano, Fedel Michele</i>	
QUANTIFYING WIND-DRIVEN RAIN INTRUSION – A COMPARATIVE STUDY ON THE WATER MANAGEMENT FEATURES OF DIFFERENT TYPES OF REAR-VENTILATED FACADE SYSTEMS	1583
<i>Arce-Recatalá Maria, Garcia-Morales Soledad, Van Den Bossche Nathan</i>	
METHODOLOGY FOR PRAXIS-ORIENTED DEVELOPMENT OF A BUILDING REFURBISHMENT CONCEPT INCLUDING CONSIDERATION OF POTENTIALLY EXISTING MOISTURE RELATED PROBLEMS AND FACADE RESTORATION MEASURES	1590
<i>Sonntag Heike, Grunewald John</i>	
A CASE STUDY: THE EFFECT OF FLOORING RENOVATION WITH ADSORPTIVE CLOTH ON THE RESIDUAL EMISSIONS OF 2-ETHYL-1-HEXANOL AND C9-C10 ALCOHOLS.....	1597
<i>Pitkaranta Miia J., Lehtimaa Timo</i>	
HIGH AIR RELATIVE HUMIDITY AND LIGHTING MODES GOVERN MOULD GROWTHS ON DAMP SOIL RUINS’ SURFACE IN HIGH-HUMIDITY REGIONS	1601
<i>Li Yonghui, Zhang Weilun, Wu Ruobin, Dang Xinyuan, Hokoi Shuichi</i>	
VALIDATION OF A COUPLED PRESSURE-EQUALIZATION-THERMAL-MECHANICAL MODEL TO STUDY DOUBLE-SKIN FACADES	1608
<i>Van Den Bossche Nathan, Van Den Brande Kjartan, De Bleecker Henk, Lori Guido</i>	
ACOUSTICAL AND AIRFLOW CONSIDERATIONS CONCERNING DOUBLE-LAYERED FAÇADES WITH OPENINGS FOR NATURAL VENTILATION	1616
<i>Mahdavi Ardeshir, Najaf Khosravi Shiva</i>	

ESTIMATING THERMAL TRANSMITTANCE OF THE ALUMINIUM WINDOW PROFILES IN PRACTICE	1621
<i>Witek Arkadiusz, Pietruszka Barbara</i>	
COLOUR DEGRADATION OF FAÇADE COATINGS – THE EFFECT OF NANOPIGMENTS INCORPORATION	1629
<i>Ramos Nuno M. M., Souza Andrea R., Maia Joana, Almeida Ricardo M. S. F.</i>	
DESIGN AND MONITORING OF ENERGY-ACTIVE FACADE MODULE	1636
<i>Pokorny Nikola, Matuska Tomas, Jirka Vladimir, Sourek Borivoj</i>	
EXPLORING NOVEL SOLUTIONS FOR INCORPORATING VACUUM GLAZING IN NEW AND EXISTING WINDOW CONSTRUCTIONS.....	1642
<i>Pont Ulrich, Woltzl Magdalena, Schuss Matthias, Schober Peter, Mahdavi Ardeshir</i>	
STUDIES ON INTERNAL SURFACE HEAT TRANSFER IN THE WINDOW AREA	1650
<i>Tywnoniak Jan, Stanek Kamil, Kny Martin, Adamovský Daniel</i>	
STUDY ON THE PERFORMANCE OF ADJUSTABLE PLATFORM SCREEN DOOR IN SUBWAY STATIONS	1656
<i>Ziyi Su, Xiaofeng Li, Yue Zhang</i>	
STUDY ON THE COOLING EFFECT OF WINDOW GARDENS.....	1663
<i>Ren Jing, Tang Ming Fang</i>	
THE IMPACTS OF DIFFERENT FAÇADE TYPES ON ENERGY USE IN RESIDENTIAL BUILDINGS	1667
<i>Tokbolat Serik, Naizabekov Yelaman, Mariani Stefano</i>	
DATA DRIVEN PROCESS FOR THE ENERGY ASSESSMENT OF BUILDING ENVELOPE RETROFITS.....	1673
<i>Garay-Martinez Roberto, Arregi Benat, Lumbreras Mikel, Zurro Belén, Gonzalez Jose Manuel, Hernandez Jose Luis</i>	
MONITORING AND THERMAL PERFORMANCE EVALUATION OF TWO BUILDING ENVELOPE SOLUTIONS IN AN APARTMENT BUILDING	1678
<i>Arregi Benat, Garay-Martinez Roberto, Astudillo Julen, Ramos Juan Carlos</i>	
A FIELD STUDY ON GROUND ENERGY BALANCE CALCULATION FOR TYPICAL COMMUNITIES IN SOUTH CHINA.....	1685
<i>Li Riyi, Zhang Yufeng, Huang Chongyun, He Chundian</i>	
POTENTIAL OF RENEWABLE ENERGY SOURCES USAGE IN AN ENERGY DEMAND OF A SINGLE-FAMILY HOUSES NEIGHBOURHOOD, CONSTITUTING AN ENERGY CLUSTER – A CASE STUDY	1693
<i>Zygmunt Marcin, Gawin Dariusz</i>	
PROPOSED METHOD FOR PROBABILISTIC RISK ANALYSIS USING BUILDING PERFORMANCE SIMULATIONS AND STOCHASTIC PARAMETERS	1702
<i>Ekstrom Tomas, Burke Stephen, Harderup Lars-Erik, Arfvidsson Jesper</i>	
COMPUTER VISION-BASED READER FOR ANALOGUE ENERGY/WATER METERS IN LOW-COST EMBEDDED SYSTEM: A CASE STUDY IN AN OFFICE BUILDING IN SCOTLAND.....	1710
<i>Adalberto Guerra-Cabrera, Giulia Barbano, Giovanni Tardioli, Girish Mallya Udupi</i>	

PARAMETRIC ENERGY SIMULATIONS OF A NORDIC DETACHED HOUSE HEATED BY A WOOD STOVE.....	1718
<i>Thalfeldt Martin, Skare Anders, Georges Laurent, Skreiberg Oyvind</i>	
IMPACT OF REFLECTIVE ROOFS ON THE OVERALL ENERGY SAVINGS OF WHOLE BUILDINGS	1725
<i>Saber Hamed H., Hajiah Ali E., Maref Wahid</i>	
MODIFICATION OF BUILDING ENERGY SIMULATION TOOL TRNSYS FOR MODELLING NONLINEAR HEAT AND MOISTURE TRANSFER PHENOMENA BY TRNSYS/MATLAB INTEGRATION.....	1738
<i>Nayak Ajaya Ketan, Hagishima Aya</i>	
APPLICATION OF OCCUPANCY AND BOOKING INFORMATION TO OPTIMIZE SPACE AND ENERGY USE IN HIGHER EDUCATION INSTITUTIONS	1746
<i>Azizi Shoaib, Rabiee Ramtin, Nair Gireesh, Olofsson Thomas</i>	
PROPOSED METHOD FOR PROBABILISTIC ENERGY SIMULATIONS FOR MULTI- FAMILY DWELLINGS	1754
<i>Burke Stephen, Carling Par, Davidsson Henrik, Davidsson Kristin, Ekstrom Tomas, Harderup Lars-Erik, Kronvall Johnny, Sahlin Per, Sundling Rikard, Wiktorsson Magnus</i>	

Author Index