ibpsaNEWS

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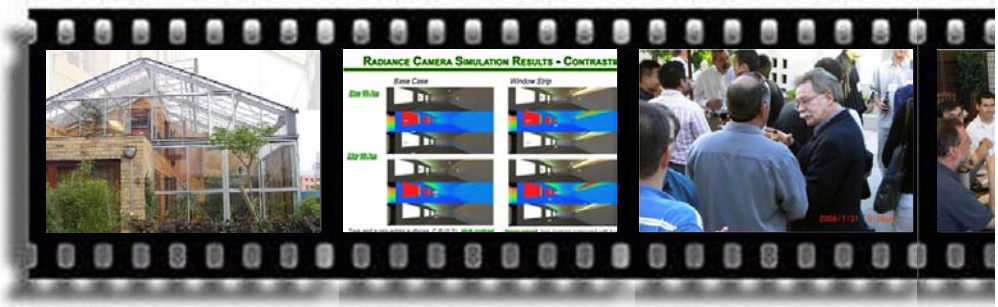
Apr 2009

IBPSA around the world ...

Canada China England Japan



Netherlands + Flanders UAE USA

Inside:

- Articles on modelling underfloor air distribution systems and the role of wind in natural ventilation simulation
- 16 events for your diaries
- News from 10 IBPSA affiliates
- New design tools, including commercial building benchmarks, a plug-in for Google SketchUp and a new version for EnergyPlus, and a new interactive guide for sustainable building design from Autodesk

Contents

The International Building Performance Simulation Association (IBPSA) exists to advance and promote the science of building performance simulation in order to improve the design, construction, operation and maintenance of new and existing buildings worldwide.

President's message

IBPSA Members and Friends,

As indicated in the previous issue of IBPSA News I would like to inform you about the annual Board of Directors meeting which was held last October in Glasgow. This was actually the first time that we started with separate meetings of the IBPSA committees, which are briefly introduced below.

The Conferences committee is chaired by Ian Beausoleil-Morrison. The members are Jeff Spitler as the Future Conference Location Coordinator, Yingxin Zhu (Chair of Building Simulation 2007), Michel Bernier (Chair of Building Simulation 2005), Jan Hensen (Chair of Building Simulation 2003) and Roberto Lamberts (Chair of Building Simulation 2001). The Conferences committee's mandate is to liaise between conference organizers and IBPSA to carry forward experiences from previous conferences and to assist conference organizers to evolve the Building Simulation conferences in a manner that is consistent with IBPSA's objectives.

The main topics of discussion in Glasgow were the evaluation of the very successful Building Simulation 2007 in Beijing conference; the preparations for Building Simulation 2009 in Glasgow (see elsewhere in this issue of News); and the location and organization of Building Simulation 2011 (to be announced at the Glasgow conference in July).

The Honors and Awards committee is chaired by Lori McElroy. The members are Ian Beausoleil-Morrison, Jonathan Wright, Wim Plokker and Gerhard Zweifel. The Honors and Awards committee's mandate is to co-ordinate and administer IBPSA's biennial awards for contributions to the field of building performance simulation. These awards are: Award for Distinguished Service to Building Simulation; Outstanding Young Contributor Award; and Outstanding Practice Award. The committee also coordinates and administers IBPSA's student travel awards, which assist a small number of students worldwide to attend IBPSA's biennial international conferences.

The main topics of discussion in Glasgow were the award selection procedures; format of presentation of awards; naming of the student awards; and publicity regarding the awards. The committee also discussed a new honors category, namely IBPSA Fellow.

The Membership Development committee is chaired by Jonathan Wright and the members are Drury Crawley (as the Affiliate Liaison), Chip Barnaby, Roberto Lamberts, Christoph van Treeck, Lori McElroy, Jeff Spitler and Karel Kabele (Affiliate Developments). The Membership Development committee's mandate focuses on membership levels, benefits and programs.

The main topics of discussion at the board meeting were Corporate Membership (definition, fees, application procedure, etc); IBPSA Member (requirement/conditions,

potential benefits, member database); and IBPSA Fellow (requirement/conditions, nomination and evaluation procedure, implementation schedule).

The Public Relations committee is chaired by Larry Degelman with members Veronica Soebarto as the News Editor-in-Chief, Roberto Lamberts as the Webmaster, Etienne Wurtz and Marion Bartholomew as the News Production Editor. The Public Relation committee's mission is to facilitate outreach functions within IBPSA that ally us with other scientific organizations and journals that share common interests in building simulation. The committee's mandate is to instigate and promote new avenues for improvements to the IBPSA News publication, including its content, frequency, size, and sponsorship. This involves initiating and maintaining interactions and alliances with outside organizations such AIVC, AIR, Buildings and Environment, Energy and Buildings, bldgsim blog, IBPSA's own website, and IBPSA's Journal of Building Performance Simulation.

The main topics of discussion in Glasgow were the committee's mission, mandate and scope; interaction with the Membership Development and Website committees; alliances with other organizations such as REHVA, ASHRAE, CIBSE and CSIRO; funding opportunities; News costs; and list server(s). The last item was actually transferred to the Web committee.

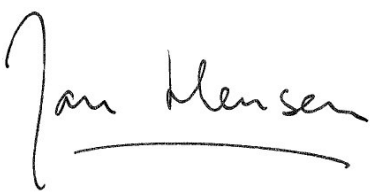
The Web committee is chaired by Roberto Lamberts. Members are Chip Barnaby, Christoph van Treeck, Karel Kabele and Drury Crawley. The Web committee's mandate focuses on development and maintenance of IBPSA's presence on the world wide web. Main topics of discussion at the board meeting were review of the current site; update of content; backup; hosting services; searchability; and possible change to a content management system based site.

In addition to the above, we discussed board management and planning; new affiliate initiatives (currently plans in more than 10 different countries!), financial status and budget plan.

Finally we talked about the IBPSA Journal of Building Performance Simulation (**www.informaworld.com/jbps**), which is now in its second year. The feedback has been fantastic, and we are now preparing the citation index evaluation request in order to get an ISI impact factor. You can read more about the journal further on in this issue of News.

Please enjoy reading IBPSA News, and I'm looking forward to meeting you at Building Simulation 2009 in Glasgow. Don't miss it!

Best wishes,



Journal of Building Performance Simulation: update

The first issue of Volume 2 of Journal of Building Performance Simulation, the official journal of IBPSA, has been published and is available online. It contains the following papers (all URLs valid at 24 March 2009):

Ribberink, Hajo, Bourgeois, Denis & Beausoleil-Morrison, Ian (2009). A plausible forecast of the energy and emissions performance of mature-technology Stirling engine residential cogeneration systems in Canada. Journal of Building Performance Simulation, 2 (1), 47-61.
www.informaworld.com/10.1080/19401490802651925

Beausoleil-Morrison, Ian, Griffith, Brent, Vesanen, Teemu & Weber, Andreas (2009). A demonstration of the effectiveness of inter-program comparative testing for diagnosing and repairing solution and coding errors in building simulation programs. Journal of Building Performance Simulation, 2 (1), 63-73.
www.informaworld.com/10.1080/19401490802559409

Dorer, Viktor & Weber, Andreas (2009). Energy and carbon emission footprint of micro-CHP systems in residential buildings of different energy demand levels. Journal of Building Performance Simulation, 2 (1), 31-46.
www.informaworld.com/10.1080/19401490802596435

Ferguson, Alex, Kelly, Nick, Weber, Andreas & Griffith, Brent (2009). Modelling residential-scale combustion-based cogeneration in building simulation. Journal of Building Performance Simulation, 2 (1), 1-14.
www.informaworld.com/10.1080/19401490802588424

Armstrong, Marianne M., Swinton, Mike C., Ribberink, Hajo, Beausoleil-Morrison, Ian & Millette, Jocelyn (2009). Synthetically derived profiles for representing occupant-driven electric loads in Canadian housing. Journal of Building Performance Simulation, 2 (1), 15-30.
www.informaworld.com/10.1080/19401490802706653

There is more information about the Journal of Building Performance Simulation in the flyer at the end of this issue of *ibpsa*NEWS.

To subscribe, visit:
www.informaworld.com/smpp/title~content=t787187009~db=all?tab=subscribe

Building Simulation 2009
University of Strathclyde
Glasgow, Scotland
27th – 30th July 2009

www.bs2009.org.uk

Building Simulation '09

Organisation of the BS 2009 Conference in Glasgow is now in full swing. The programme is now defined in outline, the scientific review process is well underway, and, not least, the ceilidh band has been booked for the conference banquet.

The website contains the latest information about the conference: details of the location, travel and accommodation options, the exhibition, prizes and awards information, conference fees, etc. There is also a full programme of evening events in addition to the scientific part of the conference and accompanying persons' tours.

The registration process is now open and participants have until 1st of June to get the early registration discounted fee. Student travel awards are available. There is also a student modelling competition open to all registered students - please let students know of this opportunity to make their mark.

Over 520 abstracts were initially submitted, leading to 340 full papers, which exceeded our expectations. These papers are now undergoing review. Authors will be notified of the review feedback in early April. For accepted papers, the final version is expected at the end of April.

For this conference, one day will be devoted to an "Applications Day" focusing on the increased use of building simulation in a commercial context by practitioners. There will be a number of plenary speakers (names soon to be announced on the website), papers with an applications-focus in a number of parallel sessions, contributions from the CIBSE Schools Group, vendor presentations from leading software houses, and panel discussions on current research and practice challenges.

There is more infomation about BS '09 in **the flyer at the end of this issue of ibpsaNEWS** and on the website, www.bs2009.org.uk.

Looking forward to seeing you in Glasgow.

Lori McElroy and Paul Strachan

Forthcoming events calendar

Date(s)	Event	Information
2009		
8-10 May 2009	**NAHB National Green Building Conference** Dallas, USA	**www.nahb.org/conference_details.aspx?conferenceID=59**
11-16 May 2009	**Solar 2009: ASES National Solar Conference** Buffalo, New York	**www.solar2009.org**
27-29 May 2009	**ICSDC 2009: International Conference on Sustainable Design & Construction** Tokyo, Japan	**www.waset.org/wcset09/tokyo/icsdc/index.html**
27-29 May 2009	**ICSEST 2009: International Conference on Sustainable Energy Systems & Technologies** Tokyo, Japan	**www.waset.org/wcset09/tokyo/icsest/index.html**
15-19 June 2009	**SASBE: 3rd CIB International Conference on Smart & Sustainable Building Environments** Delft, Netherlands	**www.sasbe2009.com/index.html**
15-18 June 2009	**IBPC: 4th International Building Physics Conference** Istanbul, Turkey	**www.ibpc4istanbul.itu.edu.tr**
20-24 June 2009	**ASHRAE 2009 Annual Conference** Louisville, Kentucky, USA	**www.ashrae.org /events/page/1630**
23-25 June 2009	**Energy & Sustainability 2009** Bologna, Italy	**www.wessex.ac.uk/09-conferences/energy-and-sustainability-2009.html**
27-30 July 2009	**Building Simulation 2009** Glasgow, Scotland, UK	**www.bs2009.org.uk**
29 September - 02 October 2009	**Solar 09: ANZSES 2009 Annual Conference** Townsville, Queensland, Australia	**http://eng1.jcu.edu.au/anzses/**
11-14 October 2009	**ISES Solar World Congress 2009** Johannesburg, South Africa	**www.swc2009.co.za**
22-23 October 2009	**8th International Radiance Workshop** Cambridge, Massachusetts, USA	Christoph Reinhart **reinhart@gsd.harvard.edu**

continues over page

26-28 November 2009	**RENEXPO: International Trade Fair & Conference for Renewable Energy & Passive House** Salzburg, Austria	**www.renexpo-austria.com**
2010		
18-21 January 2010	**World Future Energy Summit** Abu Dhabi	**www.worldfutureenergysummit.com**
23-27 January 2010	**ASHRAE 2010 Winter Conference** Orlando, Florida, USA	**www.ashrae.org /events/page/957**
29-31 March 2010	**ICSDC 2010: International Conference on Sustainable Design & Construction** Buenos Aires, Argentina	**www.waset.org/wcset10/buenosaires/icsdc/index.html**

15-19 June 2009
Delft, Netherlands
www.sasbe2009.com/index.html

3rd CIB International Conference on Smart & Sustainable Building Environments

CIB

Are climate change and the depletion of natural resources a problem? Perhaps. We prefer to see them as the ultimate opportunity to do things right, the lever to propel sustainable development. We invite everyone to join us in presenting solutions rather than problems at SASBE2009, the biggest event in Europe on sustainable building and development before 2011.

Striving for efficiency has delivered performances close to 100%, but not in sustainability. We need to do things differently. Effectiveness before efficiency, creativity before directives.

The emphasis at SASBE conferences is on an integrated approach via different disciplines and different scales. SASBE2009 focuses on smart solutions for the built environment in a changing climate. It supports a positive approach that uses climate change and limited resources as a stimulus for better planning, design and construction, and the development of smart, clean and effective technologies, cradle to grave. Themes include:

- **Climate change**: Climate change effects on the built environment, Planning for climate change, Building in water, Climate-robust building design, CO2-balanced building
- **Policy and progress:** Politics and sustainability, Real estate management and sustainability, Community involvement, Environment-behaviour interaction, Economics of urban sustainability, Impact Assessment
- **Developing regions:** Sustainability for developing countries, Rural developments, Informal settlements, Low-cost building, Design for calamities

- **Sustainable design:** Urban planning and redevelopment, Low-exergy planning and design, Vernacular architecture, Smart and bioclimatic architecture, Sustainable renovation and refurbishment, Green buildings (case studies)
- **Building & transformation:** Functionally neutral buildings, Design for reconfiguration, Industrial, flexible and demountable buildings, Integrated life cycle design methodologies, Users and transformable buildings, Business models for transformable buildings
- **Smart technology:** Innovative (energy) technologies, Smart systems and products, Adaptive and responsive building skins, Healthy indoor environments, User-system interaction, Use of IT in design, Infrastructures and transport
- **Closing cycles:** Interconnection strategies and technologies, Centralised versus decentralised solutions, Cradle to grave: closing material cycles, Self-provision of energy & exergy-based concepts, Decentralised concepts for water and sanitation, Urban Agriculture, Waste management in the built environment
- **Green manufacturing & construction:** Dematerialisation in structural engineering, Reuse of building elements in construction, Design for disassembly, Material and component recovery from buildings, Remanufacturing strategies and technologies, Green process innovations, Zero waste in manufacturing and construction

Come to Delft from 15 to 19 June 2009 and join us in making the built environment a pleasant place for everyone.

For more information and booking, visit **www.sasbe2009.com/index.html.**

15-18 June 2009
Istanbul, Turkey
www.ibpc4istanbul.itu.edu.tr

4th International Building Physics Conference

International Association of Building Physics and the Faculty of Architecture, Istanbul Technical University

The main theme of this year's International Building Physics Conference is Energy Efficiency and New Approaches in Building Physics. Its main aim is to provide a forum for scientists, researchers and practitioners from all over the world to disseminate technical information, new ideas and latest developments and discuss future directions in the field of building physics. It is also an opportunity for developed and developing countries to exchange their knowledge and experiences.

The 4th International Building Physics Conference is being held at the ITU Faculty of Architecture on the European side of Istanbul, at the heart of the city centre. Istanbul is renowned for its rich history and magnificent scenery, and it is the only city in the world that straddles two continents, Asia and Europe, which face each other here across the narrow strait of the Bosphorus. Accommodation is in 4* and 5* hotels within a few minutes' drive of the Faculty. The conference includes a social programme which offers an opportunity to enjoy this unique and ancient city, and leave with unforgettable memories.

Themes include:

- **Building materials:** Heat, air and mass transfer in materials, Emissions by materials, Performance of materials
- **Building envelope systems:** Design and performance of building envelope, Facade technology, Fenestration, Building envelope and systems integration
- **Whole buildings - sustainability and energy efficiency:** Low energy buildings, Energy efficiency, Evaluation of global hydrothermal performance, Thermal performance, Usage of passive and hybrid means, Highly efficient building, Sustainable design strategies, Renewable energy applications, Life cycle cost
- **Whole buildings - Building physics technologies:** Measuring, simulating and modeling techniques, HVAC and building service systems, Lighting systems, Active fire protection measurements, Whole building system optimization
- **Usability, safety, comfort and indoor air quality:** Thermal, acoustical and visual comfort, Indoor climate, Indoor air quality, Natural ventilation, Passive design parameters, Indoor environmental quality studies, Solar control, Daylighting, Smoke movement control and smoke extraction, Construction and Compartmentation, Means of egress, Air tightness and air movement, Shading and glazing design optimization
- **Urban physics:** Building responses to the climate, Design and engineering with climate, Conservation of energy and environment, Impact of Wind and Storm on City Life and Built Environment, Site microclimate modeling, Site safety
- **Standards, Codes, and Regulations**

For more information and booking, visit **www.ibpc4istanbul.itu.edu.tr.**

20-24 June 2009
Louisville, Kentucky, USA
www.ashrae.org/events/page/1630

ASHRAE 2009 Annual Conference

ASHRAE

This year's ASHRAE Annual Conference focuses on Managing Air Quality, with tracks on applications, business management, exergy, fundamentals, high performance systems, indoor air quality, large building systems, operational topics, refrigeration, sustainability and LEED, and systems and equipment.

In addition to the technical sessions, there is the usual wide range of tours and social events, including a welcome party, President's Luncheon and Member's Night Out, technical visits to Scribner Place YMCA and Aquatic Center Scribner Place, Louisville

Medical Center and University of Louisville, and opportunities for sightseeing at Falls and Hubers Farm, the Marengo Cave, and historic Bardstown.

Highlights of the four main days include:

- **Sunday 21 June**
  - Survivor's guide for businesses
  - Technical plenary: Adapting for 3°C climate change.
  - GSHP systems: sessions on design tools for residential installations and design of hybrid systems
  - Healthcare facility energy use
  - Moisture management sessions on part-load conditions and case studies in litigation
  - ASHRAE's new commissioning guidelines

- **Monday 22 June**
  - Opportunities: free cooling for data centers... and challenges: telecommunications centers.
  - Large building systems track begins today.
  - Make your sustainable building…work!
  - BIM is back—for HVAC engineers
  - Is 30% more outdoor air really better?
  - Tunnel ventilation and smoke control challenges in high rise buildings

- **Tuesday 23 June**
  - Cost impacts of ASHRAE's new IAQ guide.
  - HVAC applications sessions: cleanrooms, indoor sports facilities,entertainment venues.
  - Laboratory exhaust and design sessions
  - Fans' contributions to achieving Standard 90.1
  - Live debate: are cities sustainable?
  - Buildings update: the first 100 days.
  - Meet the authors: 40 papers presented in a one-on-one, Q&A discussion-format poster session

- **Wednesday 24 June**
  - Ventilation and IAQ issues in ASHRAE's residential standards
  - Next generation refrigerants for chillers
  - Emerging applications in low temperature refrigeration
  - Large office building design and commissioning
  - Control of ozone
  - Commissioning to improve sustainability and IAQ in existing buildings

For more information and booking visit **www.ashrae.org/events/page/1630**.

23-25 June 2009
Bologna, Italy
www.wessex.ac.uk/09-conferences/energy-and-sustainability-2009.html

Energy & Sustainability 2009

Wessex Institute of Technology

Energy & Sustainability 2009 aims to bring together researchers and practitioners from academia, industry and government interested in current developments in energy systems. It is being organised by the Wessex Institute of Technology, in association with the American Society of Civil Engineers and the Chartered Institution of Water and Environmental Management.

The venue, Bologna, is the oldest University town in Europe. Located on the south-eastern side of the Po Valley in the foothills of the Apennines, it is less than two hours from Rome, Florence and Venice. Now a busy modern commercial centre, the city has preserved its Renaissance charms in a centre of beautiful porticos, medieval towers, palaces, and monumental churches, interspersed with traditional shopping streets, modern theatres and restaurants.

The conference is being held at the Royal Hotel Carlton, in the city centre close to the main railway station and only 5km from Bologna International Airport. Accommodation is available in the hotel, at special conference rates. Please book as soon as possible to ensure that you can take advantage of these.

Topics include:

- Energy Management
- Energy and the Environment
- Energy Markets and Policy
- Energy Efficiency
- Computer Modelling
- Energy Resources Management
- Nuclear Fuels
- Energy and Built Environment
- Energy and Life Cycle Analysis
- Education and Training
- Energy Systems and Pollution Control
- Energy and Climate Change
- Renewable Energy Technologies
- Energy Analysis of Industrial Processes
- Exergy Studies
- Hydrocarbon Exploration and Recovery
- Energy and Transport
- Energy Production and Distribution

For more information and booking, visit **www.wessex.ac.uk/09-conferences/energy-and-sustainability-2009.html.**

27-30 July 2009
Glasgow, Scotland, UK
www.bs2009.org.uk

Building Simulation '09

See page 6 and the flyer at the end of this issue of *ibpsa*NEWS

29 September - 02 October 2009
Townsville, Queensland, Australia
http://eng1.jcu.edu.au/anzses/

Solar 09: ANZSES 2009 Annual Conference

Australian and New Zealand Solar Energy Society and James Cook University

The ANZSES's annual conferences have a reputation for bringing together professionals from all energy-related sectors, from Australia and Overseas, to meet and exchange new ideas, and discuss the latest developments in the area of clean energy technologies.

The Solar 09 conference will be a major opportunity for researchers in the subjects related to renewable energy sustainability and application to mix with other scientists, and industrialists.

Solar 09 is being held in the Jupiters Hotel in Townsville, Queensland's Solar City, on the north-eastern coast of Australia. The conference will include an opportunity to visit the Magnetic Island National Park, a few miles offshore.

There are direct flights to Townsville from Melbourne, Sydney, Brisbane and several other cities and towns across Australia. Accommodation is available in the conference venue (at special rates for delegates) and at a selection of other hotels a short distance away.

Conference topics include:

- Solar Photovoltaic
- Solar Thermal
- Wind
- Biomass
- RAPS
- Storage Technologies
- Energy Efficiency
- Developing Countries
- Renewable Energy Education
- Policy Issues
- Economy of Renewable Energy
- Sustainable Building design
- Renewable Energy in Agriculture
- Solar Cities

For more information and booking, visit **http://eng1.jcu.edu.au/anzses/.**

11-14 October 2009
Johannesburg, South Africa
www.swc2009.co.za

ISES Solar World Congress 2009

ISES and the Sustainable Energy Society of Southern Africa (SESSA)

ISES 29th Solar World Congress will focus particularly on issues for developing countries which, like Southern Africa, have an abundance of sun and other renewable energy resources. The principal themes will be:

- Resource Assessment: Solar Energy Resources; Wind, Bio, Geo, Ocean Energy Resources
- Solar Heating and Cooling:
  - Solar Collectors and PVT
  - Thermal Storage and other Components
  - Domestic Hot Water and Combisystems
  - Solar Cooling Systems
  - Other Solar Thermal Applications
- Solar Electricity
  - PV Systems
  - PV Cells and Components
  - Solar Thermal Power
  - Wind, Bio, Geo, Ocean and Hybrid Systems
  - Fuels, Chemical and Photochemical Processes
- Solar Buildings
  - Solar Architecture and Building Integration
  - Building Material, Components and Daylighting
  - Rational Use of Energy in Buildings
- Solar Energy and Society: Strategies and Policies, Solar Cities; Marketing, Financing and Standards; Education and Training; Other Nontechnical Issues

The abstract submissions deadline for the Congress has been extended to 30 April 2009, to accommodate numerous requests from interested parties for more time to prepare their abstracts.

Information about other key dates and issues is available from **www.swc2009.co.za**.

22-23 October 2009
Cambridge, Massachusetts, USA
reinhart@gsd.harvard.edu

8th International Radiance Workshop

See **page 17** for information about this event.

Software news

EnergyPlus: Commercial building benchmarks, a plug-in for Google SketchUp and a new version all now available

Dru Crawley, DOE

Commercial building benchmarks

DOE, working with three national laboratories, has developed commercial building benchmark models - complete descriptions of buildings for whole building energy analysis using EnergyPlus. The 16 building types represent approximately 70% of the commercial buildings in the U.S., in each of 16 locations, representing all U.S. climate zones (and covering most world climates as well). Currently new construction benchmarks are available, based on ASHRAE Standard 90.1. Benchmarks are available for:

Building Type Name	Floor Area ft²	Number of Floors
Large office	498,590	12
Medium office	53,630	3
Small office	5,500	1
Warehouse	52,050	1
Stand-alone retail	24,690	1
Strip mall	22,500	1
Primary school	73,960	2
Secondary school	204,170	3
Supermarket	45,000	1
Fast food	2,500	1
Restaurant	5,500	1
Hospital	241,350	5
Outpatient health care	10,000	2
Small Hotel	43,200	2
Large Hotel	122,116	6
Midrise Apartment	33,600	4

Each Benchmark building is comprised of:

- An EnergyPlus software input file (.idf)
- An html file showing the results from the EnergyPlus simulation (.html)
- A scorecard that summarizes the inputs and results for each location (.pdf)
- The EnergyPlus TMY2 weather file (.epw).

The benchmarks can be downloaded either by building type or by location from **http://buildings.energy.gov/highperformance/benchmark.html**.

OpenStudio - EnergyPlus Simulation Plugin for Google SketchUp

OpenStudio v 1.0 was recently released by DOE. OpenStudio (formerly known as the Energy Design Plugin) is a free plugin for Google's SketchUp 3D drawing program. The plugin makes it easy to create and edit the building geometry in EnergyPlus input files and to run simulations directly within SketchUp. OpenStudio was created by the National Renewable Energy Laboratory for DOE and can be downloaded free at **www.energyplus.gov**.

OpenStudio provides users with access to all the standard SketchUp tools and capabilities while creating and editing EnergyPlus input files. Users can add as much extra detail as needed to zones and surfaces, view the building geometry from any vantage point, apply different rendering styles, and perform accurate shadowing studies. Users also can mix EnergyPlus simulation content with decorative content such as background images, landscaping, people, and architectural finish details - all within the same SketchUp model.

The OpenStudio plugin is compatible with both the Free and the Pro versions of Google SketchUp 6 & 7 for Windows. A version for Mac OS X is currently in development. OpenStudio will have full access to all of the plugin functionality once both EnergyPlus and SketchUp are installed on your computer.

More information, along with a form to register for a free download of the OpenStudio plugin and EnergyPlus, is available at **www.energyplus.gov**.

EnergyPlus version 3.1

The latest release of the EnergyPlus building energy simulation program, Version 3.1, became available in early April. A few key new features include:

- simplified rectangular geometry for walls, roofs, ceilings, floors, windows, and shading
- thermochromic windows
- upgraded UFAD model; Standard 62.1 demand control ventilation
- cool beam HVAC model
- new tabular reports to support LEED EA Credit 1 forms
- new post-processing utility to combine Standard 90.1 Appendix rotation results.

We have updated and extended capabilities throughout the existing building envelope, daylighting, and HVAC equipment and systems portions of the program, along with many other enhancements and speed improvements. These are in addition to new features of Version 3.0, released in November 2008, which include new datasets, input syntax changes, updated zone and ventilation controls and models, enhanced cost calculations and economic reporting, and extended documentation and guides.

The OpenStudio plugin for Google SketchUp has also been updated to work with EnergyPlus V3.1. EnergyPlus is available for Windows, Linux, and Macintosh operating systems.

For more information about the new and other features of EnergyPlus and to obtain EnergyPlus Version 3.1 and the OpenStudio plugin at no cost, visit the EnergyPlus web site at **www.energyplus.gov**.

Building Energy Tools Directory

Dru Crawley, DOE

The web-based Building Energy Tools Directory at **www.energytoolsdirectory.gov** contains information on more than 350 building-related software tools from more than 20 countries around the world. Haven't visited lately? In the past year, more than 15 new tools have been added - see the list at **www.energytoolsdirectory.gov/tools_new.cfm**. For each tool in the directory, a short description is provided along with information about technical expertise required, users, audience, input, output, validation, computer platforms, programming language, strengths, weaknesses, technical contact, availability and cost. A link is also provided for directly translating the web pages into more than 8 languages.

If you know of a tool (yours?) that is not in the directory, please send the information to **www.energytoolsdirectory.gov/submit.cfm** or in an email message to Dru Crawley at **Drury.Crawley@ee.doe.gov**.

8th International Radiance Workshop

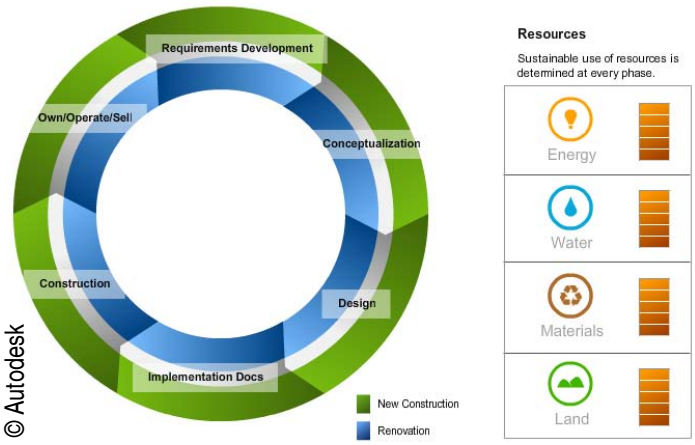
The 2009 International Radiance Workshop will take place on October 22 and 23 at Harvard University's Graduate School of Design. The school is located in Cambridge, Massachusetts, which is part of the Boston Metropolitan Area. The International Radiance Workshops are annual gatherings of developers and users of the Radiance backward ray tracer. The workshop consists of a series of presentations that in the past included case studies on the use of Radiance in lighting and/or daylighting projects, recent advances in glare detection, visual comfort and energy savings from lighting controls as well as the use of Radiance in Art and Design. At least one session is typically also dedicated to technical advances that have been made within the Radiance engine over the past year.

The 2009 workshop will be split into an 'application day' (day 1) and a more 'technical day' (day 2).

Presentations from previous workshops can be downloaded from **http://www.radiance-online.org**.

For more information please contact Christoph Reinhart at **reinhart@gsd.harvard.edu**.

Autodesk Interactive Guide for sustainable design



A new web-based interactive guide for sustainable design for architecture, engineering and construction has been published by Autodesk. The interactive guide explores each project phase for opportunities to design and deliver more sustainable projects for the full life-cycle of the project: Requirements Development, Conceptualization, Detailed Design Phase, Implementation Documentation, Construction, Own/Operate/Sell and Phase Decisions. Some specific elements (such as the pointers to other design resources) are only relevant for the US, but other aspects are quite general and applicable in other parts of the world.

The Guide is available at **http://usa.autodesk.com/adsk/servlet/index?id=12671019&siteID=123112**, and there is comment on the bldsim blog at **http://bldgsim.wordpress.com**.

MODELING OF UNDERFLOOR AIR DISTRIBUTION (UFAD) SYSTEMS

Tom Webster[1], Fred Bauman[1], Fred Buhl[2], and Allan Daly[3]
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ABSTRACT

In this paper, we discuss the development of a module that is capable for the first time of simulating UFAD systems in EnergyPlus. We describe the new models for EnergyPlus that simulate two important elements of these systems: underfloor air supply plenums and room air stratification under cooling operation. These algorithms were developed over a 5-year period of intensive interdisciplinary work consisting of theory, bench-scale and full-scale experimental testing, and computational fluid dynamics (CFD), analytical, and empirical modeling. We describe the modeling methods, show examples of a preliminary validation based on experimental data, and present results of research studies that have significantly contributed to a more complete understanding of the behavior of UFAD systems.

INTRODUCTION

Underfloor air distribution is an innovative technology that uses the underfloor plenum below a raised floor system to deliver space conditioning in offices and other commercial buildings. The use of UFAD has increased in North America during the past decade because of the broad range of potential benefits that it offers over conventional overhead air distribution systems. (Bauman and Webster 2001; Bauman 2003). Energy simulation tools are a critical missing link in the development of UFAD technology and are the only practical means of rigorously evaluating performance of these complex systems. Moreover, recent unpublished research by the authors indicates simulations that do not explicitly include supply plenums and detailed surface heat balances will not accurately capture important effects.

The technical approach for the project featured a coordinated effort by the research team to conduct extensive experimental and modeling studies to form a solid foundation for the development and validation of the two new simplified models for implementation into EnergyPlus, one on room air stratification (RAS) and one on underfloor plenums. This coordinated, multi-disciplinary approach has proven to be very successful in developing the required EnergyPlus modules as well as generating much needed new knowledge and improved understanding of the fundamental principles of UFAD system design, operation, and energy performance.

METHODS

Compared to overhead well-mixed systems, there are two primary characteristics of UFAD systems that must be accounted for to accurately simulate the energy performance of UFAD systems: (1) room air stratification, and (2) underfloor plenum thermal performance. We describe below the combination of theoretical and experimental methods we used to develop UFAD modules for these features in EnergyPlus as well as important additions to HVAC systems.

Room air stratification full scale testing

Analytical modeling techniques along with idealized bench scale tests were used to establish a physical basis for modeling room air stratification. This work is described in a companion paper by Liu and Linden (2008). This work resulted in establishing a two-layer approach to modeling the stratification in a room.

To provide a detailed understanding of how room air stratification is influenced by various design and operating conditions and to verify the findings of the theoretical work, we conducted full-scale experiments in a test chamber configured to simulate an office space.

The test facility consisted of a test chamber configured like an open office space and an adjoining weather chamber that allowed us to simulate solar gain and window heat transfer. Independently controlled HVAC equipment served these two spaces. The test room was a 7.9 m (26 ft) square with an area of 63 m² (676 ft²) and a height of 2.7 m (9 ft).

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Figure 1 shows the layout of the test chamber. Besides instrumentation, the room contained thermal manikins, personal computers, desk lamps and other equipment to create a typical office environment. The weather chamber was separated from the test chamber by a curtain wall with a double glazed clear glass window. An array of quartz lamps provided simulated solar radiation equivalent to west low-e facing glass at peak summer conditions in Kansas City.

The test facility was supported by a 150-channel data acquisition system that measured air and surface temperatures, as well as airflow and underfloor pressure. These measurements provided sufficient detail to allow us to calculate a detailed heat balance of the chamber. A complete description of full-scale testing can be found in (Bauman et al. 2007).

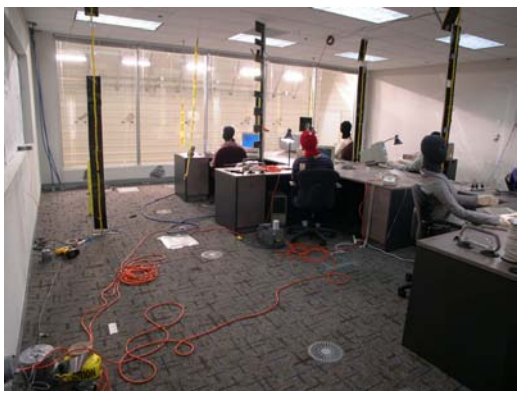

Figure 1: Photo of test chamber

In Table 1 we list the internal loads for each workstation, as well as their assumed convective fractions.

Table 1: Workstation internal loads breakdown

Internal gains breakdown	W, ea.	% Conv.
Printer	130	90%
CPU Power	33	90%
CRT Monitor power	65	65%
Manikin power	75	40%
Task light	60	40%
Total WS power	255	57%

Interior zones. We investigated the performance of three diffuser types that we typically expect to find in practice in interior zones: (1) standard swirls (SW), passive (i.e., not modulated) but user adjustable; (2) modulated variable area (VA); and (3) passive swirls with horizontal discharge (HD) that mimic to some degree displacement ventilation airflow patterns. Figure 2 (see figures at end of paper) shows test results (normalized to the same control point and supply air temperature) that compare the stratification performance for these diffusers at typical design conditions. As shown, the standard swirl diffusers operate similar to variable area diffusers but both are distinctly different from horizontal discharge swirl diffusers. Furthermore, standard swirl performance varies depending on operating conditions (Bauman et al. 2007), whereas VA and HD diffusers exhibit little variation. We note, however, that our experience with actual systems indicates that in practice real systems operate over a smaller range of variation than we tested in the laboratory.

Perimeter zones. Chamber test results for perimeter zones under peak solar load conditions exhibit performance similar to that of interior zones in the occupied zone (lower sub-zone) but more stratified in the upper sub-zone. We tested linear bar grilles, a common air distribution method used in practice, for two cases with different diffuser configurations, and for a case with the venetian blinds closed. The overall room air stratification (floor to ceiling temperature difference) for the latter is significantly greater than the others due to the effects of a stronger window plume (see Bauman et al. 2007 for more detail).

Room air stratification empirical models

In addition to modeling the supply and return plenums as fully mixed zones, we assume that the room is divided into two fully mixed sub-zones, as shown in Figure 3. EnergyPlus performs a heat balance on each sub-zone with the surface between the upper and lower layers in the room configured to be an "air surface" that is transparent to all radiation.

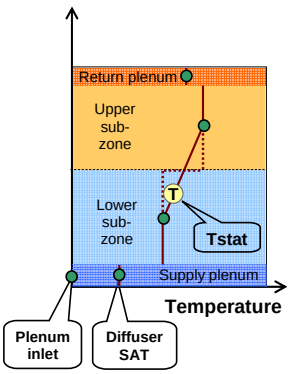

Figure 3: EnergyPlus multi-layer UFAD model

There are a number of factors that influence the degree of stratification in UFAD systems and it is important that these effects be captured in the EnergyPlus models. However, we found that the ideal analytical formulations developed by Liu and Linden (2008) were limited in their ability to represent the results of the full-scale testing. We also found that the numerical models based on these formulations could not be easily incorporated into the EnergyPlus structure. The former limitation we attributed to "real world" differences in the effects of radiant exchange, coalescing of multiple plumes and plumes at different heights, imperfect mixing in the lower sub-zone, the impact of different diffuser types, and our inability to accurately identify the stratification height in full-scale experiments.

Comparisons between full-scale and bench-scale experiments, however, indicated that the theoretically derived dimensionless parameter, Gamma, when plotted against Temperature-effectiveness ((T_eff) a non-dimensional representation of the room air stratification; see nomenclature) captured the essential physics of the stratification process. Therefore, we used correlations of Gamma versus T_eff using the full-scale test data shown in Figure 4 (see figures at end of paper) for our interior zone model in EnergyPlus.

Supply air plenum testing and modeling

We used a combination of full-scale testing and computational fluid dynamics (CFD) modeling to develop a simplified model suitable for implementation in EnergyPlus that was capable of calculating the thermal performance of underfloor air supply plenums. Steady state testing was conducted in a full-scale plenum test facility (22 ft x 48 ft x 1 ft) (Jin et al. 2006). We conducted tests for two different inlet conditions, (1) single focused jet, and (2) inlet vanes/two jets, to provide validation quality data for the plenum CFD model.

A model using the ANSYS CFX CFD program was developed to match the geometry of the plenum test facility. The CFD plenum model incorporated a standard k-ε turbulence model and a source term to represent the resistance of the pedestals that are spaced uniformly throughout the plenum. The model was validated by comparison with the full-scale experimental data. The computed air temperatures, velocities and surface heat fluxes generally agreed well with the measured data. More importantly, the discrepancies between computed and measured total heat gain of the plenum were less than 10%.

We used the validated CFD plenum model to conduct a larger number of "numerical experiments" to investigate the energy performance of underfloor plenums over a wide range of realistic plenum airflow configurations and operating conditions. A CFD sensitivity study demonstrated that total airflow rate through the plenum was the primary factor in determining the surface convection coefficients on the top of the slab and the underside of the raised floor panels. Since we can easily specify convection coefficients within EnergyPlus, we decided to use a simplified approach where we assumed the plenum to be a well-mixed zone with the expected average convection coefficient values for these two surfaces described as a function of total airflow rate (Bauman et al. 2007). As indicated above, we expect this assumption to result in errors of less than 10% in the prediction in the underfloor energy balance.

EnergyPlus integration

Non-uniform zone models: EnergyPlus is based upon the heat balance method within a single zone. The basic zone model convectively couples all the surfaces to a single room air node. Further development of the program has led to the introduction of multiple air node zone models. The available models are divided into two primary types: models with user-specified predefined nodes, and the models that divide the zone vertically into a series of well-mixed sub-zones with thicknesses depending on load and airflow rate. In order to choose a non-uniform zone model, a RoomAirModel object was created. This object allows the user to choose from among a variety of non-uniform models from well mixed to various multi-node models including two-node models for interior and perimeter zones of UFAD systems (DOE 2007). Each choice requires further input specific to the model chosen. For the UFAD project, we developed two new room air models: interior UFAD and exterior UFAD. Both are two node (two sub-zones) models similar to the EnergyPlus' displacement ventilation model. For modeling these zones, we developed an entirely new module, *UFADManager*. This module contains the routines that set the access points, initialize parameters, sets input defaults for zone model and diffuser type, sets convection coefficients for room surfaces, and calculates sub-zone boundary height.

The most important feature of the UFAD zone models is that separate convective heat balances are performed yielding separate average air temperatures for each sub-zone. The convective heat transfer at zone surfaces is calculated at the subzone level using the subzone air temperatures. We found that the most

straightforward way to simulate stratification is to divide the convective energy gains between the upper and lower sub-zones. We used the Gamma vs. T_eff correlations shown in Figure 4 to split the previous time step's extraction rate (i.e., the net convective gains) between the sub-zones.

Supply air plenums: A major barrier to modeling UFAD systems has been the inability to model supply air plenums. In the early phases of the UFAD project, we enhanced EnergyPlus to permit a general configuration of supply plenums in the supply air path. This gives the program the capability of using various series and parallel supply plenum configurations. We still model these plenum zones as well-mixed zones with a single average air temperature. We can model temperature gain (thermal decay) by concatenating plenums in series. We thought that treating supply plenums as normal zones would prove to be inadequate. However, validation studies as described above showed that simply varying the convection coefficients at the upper and lower surfaces produced good agreement.

New HVAC systems

At the beginning of the UFAD project, we identified two HVAC modeling capabilities not yet in EnergyPlus that are vital to providing a comprehensive simulation of UFAD systems: a variable-speed fan terminal unit and return air bypass (RAB) capability.

Variable-speed fan coil: To simulate systems commonly used in practice, we developed a variable speed fan coil unit, which can control the flow of cool or reheated supply air to the zone. It has separate maximum cooling and heating airflow rates. The model is fully iterative – it makes no assumptions about the linearity of its subcomponent models. An example of the model's use is contained in example input *5ZoneSupRetPlenVSATU.idf* contained on all EnergyPlus releases since version 1.2.1.

Return air bypass (RAB): EnergyPlus has a theoretically general HVAC duct configuration capability, but the allowed configurations have always been limited in practice. With this capability, single splitters on the air-system supply side could be used to simulate single and dual duct systems. There was no provision for a mixer and splitter, as is needed for a return air bypass system, or any means for controlling such a system. This capability is needed to accurately simulate UFAD systems since these systems often use a higher than normal supply air temperature. A conventional single duct setup would have difficulty removing sufficient moisture from the mixed air to maintain comfortable zone humidity levels without using reheat. RAB configurations are often applied in humid climates to mitigate this problem in UFAD systems.

Creating the capability to model return air bypass duct configurations in EnergyPlus required three new elements: A primary air loop mixer, an air-side branching pass-through unit (called Duct that operates similar to the Pipe component in the Plant program), and a flow controller for the branch which consists of a new setpoint manager. Figure 5 shows a schematic of the RAB system.

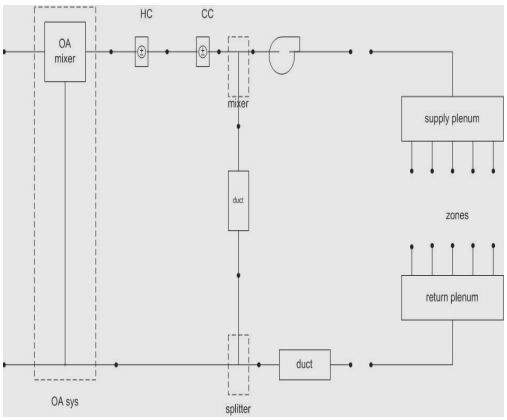

Figure 5: Return air bypass schematic diagram

The complete RAB simulation capability was released with EnergyPlus version 1.2.3 in October 2005. An example input illustrating the capability is contained in *5ZoneSupRetPlenRAB.idf*.

Test chamber model and simulation interface

To assist with validating the EnergyPlus/UFAD simulation module we developed a fully detailed EnergyPlus model of the test chamber as shown in Figure 6. We divided walls and floors into multiple segments to allow direct assignment of solar gains to each segment to assist with validation of the perimeter UFAD simulation model. Because the quartz array does not represent true solar gain or its spectral distribution, we used a special version of EnergyPlus for perimeter zone simulations that included a customized method of accounting for the solar gain (Winkelmann 2006). Workstation furniture was modeled by replacing five of the fifteen floor segments with an insulated surface.

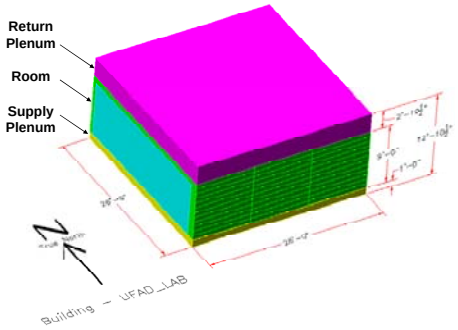

Figure 6: Test chamber model

We developed a spreadsheet-based interface (Daly 2006) to manage EnergyPlus input and output and to facilitate reconfiguration of the test chamber model to support a variety of sensitivity studies. Figure 7 is an information flow diagram of this interface.

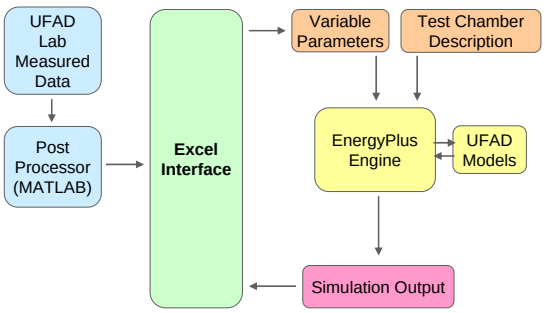

Figure 7: Test chamber simulation interface and information flow

We used test chamber measured outside wall surface temperatures to establish thermal boundary conditions; these were modeled using EnergyPlus "otherside coefficients." Internal loads and HVAC system performance data were input into the EnergyPlus simulations using processed data from the laboratory data acquisition system.

We developed methods to display the simulation results against measured test chamber data. These included tables and charts to track the chamber energy balance and to compare simulation results to measured data. Figure 8 shows an example of the chart we used to display comparison data.

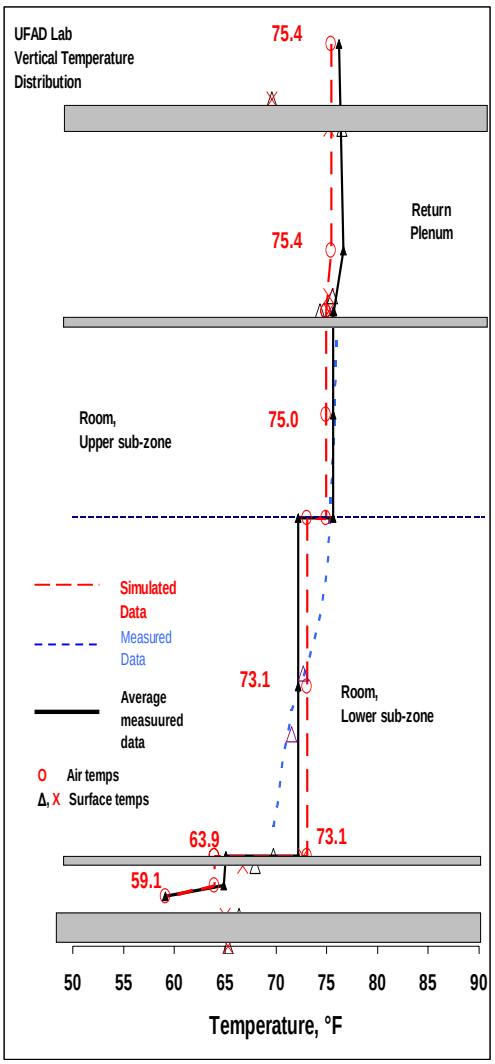

Figure 8: Temperature profile showing measured vs. simulated air and surface temperatures

RESULTS AND DISCUSSION

Heat transfer studies

One important outcome from the EnergyPlus simulations using the test chamber model was our ability to model the details of the heat transfer mechanisms that take place in these systems. Earlier work on this topic used a simplified modeling approach (Bauman et al. 2006). To accomplish this we reconfigured the chamber model to simulate an interior zone of the middle floor of a multi-story

UFAD building and conducted steady state simulations. For convenience, we defined the supply plenum bottom to be connected to the return plenum top so the two surface temperatures are equal. (A dynamic simulation would not be configured this way; it would include floor-to-floor heat transfer including thermal mass effects.) Then we set all the walls to be adiabatic and created an output report that contained all the conduction and convection components at each surface; we then back calculated the radiative component from these two. We summarize the results for one example in Figure 9 (below). Note that this figure shows the overall convective gain/loss fractions (of total internal load) in the two plenums and room that result from the complex heat transfer processes illustrated on the right side of the diagram. We can draw several important conclusions from these results:

- A substantial portion of the room load ends up in the supply plenum (48%). This is driven by heat gain from above through the raised floor and below from conduction through the slab.
- Radiation (i.e., *net* radiation at the surface) exchange between floor and ceiling is augmented by radiation from the internal equipment and people loads so that there is a net positive radiant heat transfer onto both the ceiling and floor (as opposed to just exchange between floor and ceiling)
- There is a net heat loss from the return plenum (-9%) so that the return air is being cooled as it passes to the air handler (AHU).
- The room load (extraction rate) is reduced (61%) compared to CAD systems by the loss to the supply and return plenums thereby reducing airflow requirements.

Validation results

As a preliminary step in our validation process (a full uncertainty analysis has not yet been completed) to test the efficacy of the empirical models for interior zones we ran the chamber model for 27 tests covering three diffuser types; VA, SW, and HD. The results in Figure 10 show the root mean square error (RMSE) for the differences between measured and simulated temperatures for selected air and surface temperatures. Except for the raised floor top temperature, the RMSEs for most temperatures are below 1°C, which indicates good predictability for the room stratification and plenum models. We expected the measured raised floor top temperature to be slightly lower than simulated because the temperature near the floor for the simulated case is equal to the average temperature of the lower sub-zone, while for real systems it is a few degrees cooler due to stratification in the lower sub-zone.

CONCLUSION

The small overall errors between experimentally measured and simulated air and surface temperatures shown in Figure 10 indicate that the room air stratification and supply plenum models developed under this project are capable of simulating room air stratification and supply plenum heat transfer relatively accurately. This indicates that we will be able to simulate the energy performance of interior zones (and associated supply plenums) of UFAD systems with confidence using EnergyPlus/UFAD. Furthermore, we have demonstrated that the theoretically derived parameter Gamma represents the underlying physics of the stratification process well. These, along with the development of HVAC component models, represent major steps toward providing a complete and fully validated EnergyPlus simulation module for UFAD systems. Ongoing work will complete the development of a validated perimeter zone model later in 2008. This new version of EnergyPlus will be instrumental in a wide variety of studies to investigate the energy performance of these systems while providing practitioners the ability to simulate these systems more accurately than is currently possible.

ACKNOWLEDGMENT

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NOMENCLATURE

Gamma = $$\Gamma = \frac{(Q \cdot \cos\varphi)^{\frac{3}{2}}}{m \cdot \left(\frac{n}{m} \cdot A_{eff}\right)^{\frac{5}{4}} \cdot (0.0281 \cdot W)^{\frac{1}{2}}}$$

Gamma represents the ratio of diffuser momentum to thermal plume buoyancy which embody the driving

forces for creating stratification. (See Liu and Linden 2008 and Bauman et al. 2007.)

Q = room airflow

A_{eff} = Diffuser effective area; Cos θ = discharge angle for diffuser flow

n = number of diffusers; m = number of plumes

W = total zone plume convective energy; for simulations we use the room extraction rate (i.e., the net convective energy in the zone)

Temperature_effectivness, T_eff = $(T_{OZ} - T_S)/(T_r - T_S)$; this repesents the ratio of the lower sub-zone to total room convective energy, where T_{OZ} = average lower layer (occupied zone) temperature; T_S = supply air temperature to the room; and Tr = return temperature at the top of the room

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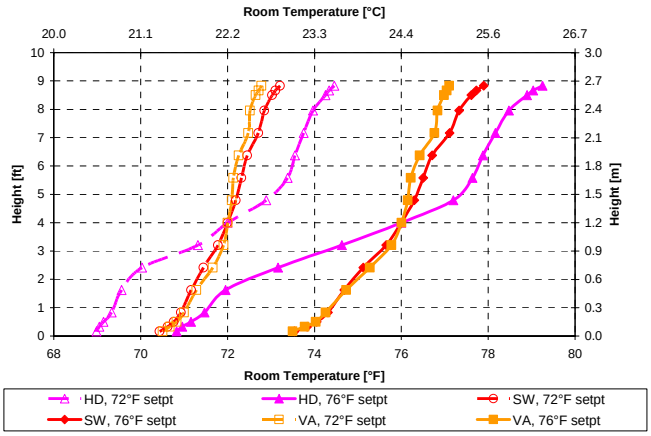

Figure 2: Comparison of VA, SW and HD diffusers under peak design conditions for interior zones

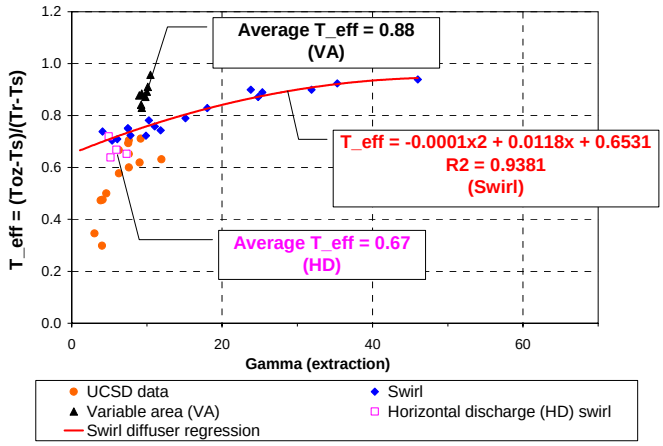

Figure 4: Empirical correlations, Gamma vs.Temperature_effectivness (T_eff) for interior zones and various diffusers

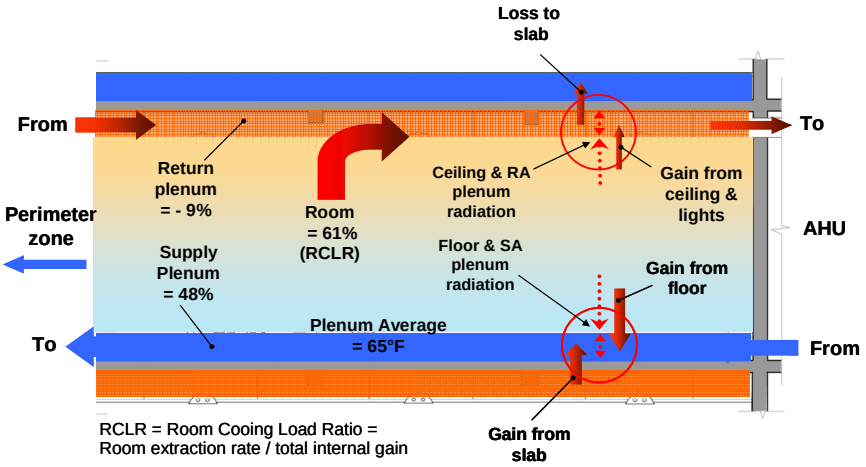

Figure 9: Heat transfer analysis summary showing the distribution of convective gains as fractions of total heat gain to the room/plenums system

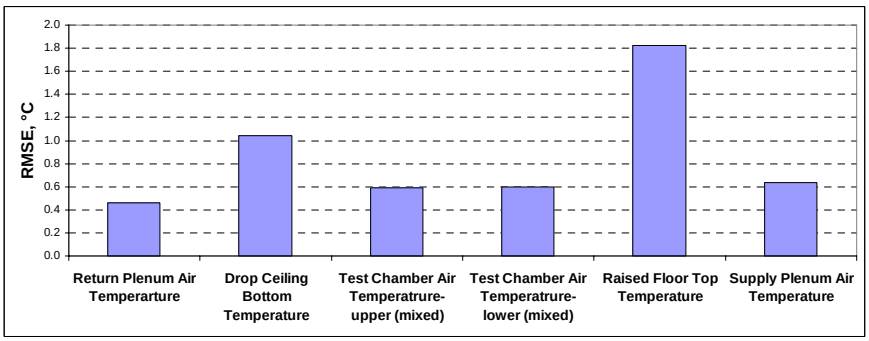

Figure 10: Validation results for all tests; temperature RMSE for selected location

THE ROLE OF WIND IN NATURAL VENTILATION SIMULATIONS USING AIRFLOW NETWORK MODELS

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ABSTRACT

Buildings have been naturally ventilated without detailed analyses for hundreds and thousands of years. For many standard and smaller buildings it can be possible to achieve satisfying designs based on experience alone. However, as a means to conserve energy while providing superior thermal comfort, natural ventilation is increasingly considered as a means to ventilate large, complex buildings, including buildings with high loads for which high performance is critical. For these types of buildings it is important to have tools for analysis of design to evaluate a design's predicted performance in order to achieve high confidence in the design. These tools are described in the present paper as well as a proposed process on designing buildings for natural ventilation. An example case study is discussed.

INTRODUCTION

High-end analyses for natural ventilation are becoming increasingly important, as we are pushing the envelope on its application. Larger and more complex buildings are designed to be either fully naturally ventilated, or partially, when mixed with mechanical ventilation.

The major tools that are used for design analyses are airflow network models and Computational Fluid Dynamics (CFD), sometimes complemented by wind tunnel studies. As the design of fully or partially naturally ventilated spaces is a complex design task, demanding thorough knowledge of fundamental physics, expert knowledge is a crucial skill as well. No design tool has yet come to the point of providing reliable answers that can be trusted without expert review. Design teams are often unclear about the different roles of these tools. These roles will be explained below.

Natural ventilation in buildings is driven by two forces: buoyancy (or stack effect) and wind. Wind is often the dominant of these forces (CIBSE, 2005).

For natural ventilation analysis, whole-building simulation programs determine the airflow across an opening by determining the pressure differential that exists across that opening. One component of the pressure differential across the opening is the pressure inside the building, which mostly depends on temperature. The other component is the wind pressure on the opening.

The flow around simple buildings in simple terrain is reasonably well understood by most. For a cube-like building, the flow approaches the building, there is a stagnation zone in front of the building and flow is diverted around the top and sides. The relative amounts of flow that are diverted around the top or sides vary depending on the dimensions of the building, the proximity of the location of interest to the top of the building and the oncoming wind conditions. The stagnation zone at the front of the building results in a positive pressure. As the flow travels across the top and around the sides of the building it tends to separate leaving a recirculation bubble on both the sides and the top. The length and strength of the recirculation bubbles depend on similar factors described above. In some cases the flow reattaches, in others it remains detached from the building. The pressure applied to the building in these locations is outwards - negative. Finally, at the rear of the building, the flow completely separates from the rear of the building and large negative pressure wake is left. In all cases, the separation zones result in pressures that fluctuate in time. If there is an upstream building, then the wake of that building and the additional turbulence can significantly change how the flow behaves as it traverses around the building of interest.

As the architecture of the proposed building becomes more complex, the elements on this building can affect other locations on the building. These impacts are not always intuitive. In order to design a naturally ventilated building using wind as one of the driving forces, one needs to have a firm understanding of the

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wind patterns around the proposed building. Given that the wind conditions at the openings drive the natural ventilation airflows inside the buildings, it is important to choose these adequately. The following section will discuss the tools commonly used in natural ventlilation design analysis and will examine the methods in which each determines wind pressure coefficients.

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NATURAL VENTILATION DESIGN TOOLS

Airflow Network Models:

Airflow network models calculate the bulk airflow movement through the building. To include all the details about the building they are coupled to thermal dynamic simulation models which resolve all the energy flows in the modeled building spaces as a result of the weather, their usage, and the construction details. Two example software tools are IES Virtual Environment (IES VE, 2008) and the combination of DesignBuilder (2008), and EnergyPlus (2008). Dynamic thermal simulations coupled with airflow network models investigate the performance of a building over the course of a typical year. Weather data and usage/operations schedules are resolved down to a one hour time step. These kinds of simulations provide information on the bulk airflow through the building and the average temperatures that can be expected in the different zones of the building that are modeled.

The airflow into the building through the openings is determined by the outside weather condition, particularly wind and temperature. The wind condition at a building is not only determined by the overall wind information from weather statistics, but also from the geometry of the building itself as well as its surroundings. Overhangs, alcoves, recesses, neighboring buildings, trees and other features influence the local wind situation significantly.

The way in which this localized wind pattern information is entered in the simulation programs is through C_p values. These parameters specify the pressure for a location on a building face depending on the overall wind situation. For natural ventilation scenarios, where all internal airflows are driven by these airflows entering the building through its openings, any errors in the C_p values will translate into the simulated overall building performance. For example, if a simulation with a thermal model coupled with an airflow model predicts a certain number of hours outside of comfort range – say 25 hours out of the occupied hours are over 27°C – the reliability of this result will be directly depending on the reliability of the C_p values.

There are default C_p values provided in the airflow network model simulation tools. These are based on the Air Infiltration and Ventilation Centre's (AIVC) Guide to Energy Efficient Ventilation (Liddament, 1996), which consists of a number of wind tunnel tests for generic, low-rise buildings. Typically these C_p values only apply as acceptable initial approximations for buildings with a shape that is close to rectangular and which does not exceed 3 or 4 storeys in height.

Computational Fluid Dynamics:

Computational Fluid Dynamics (CFD) for natural ventilation can be used for internal building flows as well as external building flows.

For internal building flows, CFD provides details about the airflow distribution within the naturally ventilated spaces. If there are stagnant zones, a CFD study will identify their location and mitigation measures can be tested in additional studies. Airspeeds in different locations within the spaces can be calculated. As well, the temperature distribution can be evaluated, providing information on areas that might be too hot or too cold. These detailed studies can include radiative heat transfer calculations, which can be used to show the effect of radiant heating and cooling, direct solar radiation through windows and openings and more. The very detailed level of information from CFD enables detailed thermal comfort evaluations. This increased level of detail and information comes at a cost as the computational time is much higher than that of an airflow network model. Thus, only snapshots in time or brief transient simulations can be calculated. To obtain information on frequency of events (such as overheating) over the course of a typical year, it is better to use airflow network models. Similar to airflow network models, the flow inside the space is driven by the airflow into and out of the space at its boundaries. Again information is needed on the airflow condition at these boundaries, which need to be input into the simulation model. The accuracy of CFD simulations of interior building flows, though not perfect, is sufficient and satisfying for these types of applications. This has been tested and validated in multiple studies (CIBSE, 2005; Ji et al., 2004, Jiang et al, 2004; Mora et al, 2002).

In general it is possible to model the flow around a building using CFD. Many commercial, freeware and

proprietary packages are available that provide access to flow solvers (FLUENT, 2008; OpenFOAM, 2008; STAR-CD, 2008). These have a variety of physics and, for the purposes of modelling flow around buildings, the most important piece of physics is the manner in which turbulence is represented. Turbulence models range from simple one-equation empirical models to multi-equation sets. Recent interest has been focused on a turbulence model referred to as Large Eddy Simulation (LES) that does a better job of modelling the large-scale turbulent fluctuations at the cost of additional computer power. This better representation of the larger scale turbulence is acknowledged as contributing to a better representation of the average wind characteristics and therefore surface pressures (Castro, 2003). Even then, it is important to understand that all CFD modelling has trouble predicting the flow around the downstream side of a building. This is doubly important for natural ventilation. The flow leaving the downstream side of upstream building impacts the building of interest and the wind driven pressures at the rear and top of the design building are critical for appropriate representation of the building ventilation flows.

As described above, both airflow network models and CFD models need information about the air inflow/outflow conditions. Even though CFD for exterior building flows are not sufficiently accurate at this point in time to replace wind tunnel testing, they nevertheless can provide good qualitative information on the local wind climate around a building that is considered for natural ventilation. Particularly in the early conceptual stages this can be very helpful while keeping the effort (time and cost) below that for a wind tunnel test. These types of CFD models can be used as a basis of early C_p value estimates for a range of options. This allows for simulations of a building at early conceptual stages including several "what-if" scenarios, which can include changes of the building shape.

C_P CALCULATION METHODS

As discussed previously, the wind pressure coefficients (C_p) used to estimate the wind-induced airflow through openings in the building façade play an important role in natural ventilation analysis. During the design phase, methods are needed to determine the C_p values. There are several methods for approximating these values, each resulting in varying levels of accuracy. Determining the appropriate level of accuracy depends on the study to which the values will be applied. These methods vary from estimates based on previous experience to detailed wind-tunnel analysis for façade and location-specific pressures.

Desktop Estimates

The desktop estimate is based on

- Known C_p values from wind tunnel tests and measurements on existing buildings,
- the shape of the building that is currently under investigation,
- site exposure, and
- expert's experience in determining the wind pressure coefficients on other structures.

The advantage of the desktop estimate is that it can be completed quickly. The level of accuracy will depend greatly on the availability of relevant data. The constrains of this approach often lead to a very rough approximation of building wind loads.

External Flow Modelling using CFD

A simplified three-dimensional computer model of the building and its surroundings is built. The surroundings (usually called the environmental domain) need to be large enough so that the blockage of the building(s) in the model is small (~5%) and some researchers recommend that the blockage be less (Franke, 2006). In addition, it is critical in these simulations of the wind environment around buildings to represent a sufficiently large domain around the building of interest in order to capture the upstream building effects.

Boundary conditions for the atmospheric boundary layer are applied. These need to represent the atmospheric boundary layer profile appropriate for the upwind terrain. Typically this means a power-law representation for the velocity profile (Smits, 2000). In addition, the incoming turbulence properties are also important and the characteristics of turbulent fluctuations vary in the three directions and are a function of altitude.

Other details of importance include the use of adequate cell resolution, grid-independence and convergence. In some cases, the presence of very large openings in the building can impact the flow around the building. This too needs to be assessed.

As mentioned before, the accuracy of CFD studies for external flows is still quite limited and needs to be carefully considered. However, a CFD study of the airflow around the building will provide an expert with more information on the specific conditions for the particular building. This additional information helps to

improve the quality of an estimate of the wind pressure coefficients C_p.

Wind Tunnel Testing

The most effective method of predicting wind pressures acting on the natural ventilatoin openings of a building is through scale model testing in a boundary layer wind tunnel.

A scale model is created of the building and is fitted with pressure taps located at each specific location on the façade where an opening is planned. In order to include the effect that adjacent terrain will have on the wind profile the surrounding terrain as well as natural and constructed obstructions are also modelled.

The wind tunnel test provides measurements of the detailed C_p values for all the openings in their respective locations.

Prediction Methods Provided in Common Software Tools

A commonly used approach in airflow network models is to transpose wind pressure information from generalizations and comparisons to stock building shapes, orientations, and terrain types tested in wind tunnels onto the study building. IES Virtual Envrionment and DesignBuilder/EnergyPlus, two widely used simulation tools for natural ventilation studies, both employ a version of this technique. Both simulation tools have based their wind tunnel reference data on the Air Infiltration and Ventilation Centre's (AIVC) Applications Guide: A guide to energy-efficient ventilation (Liddament, 1996). Limitations exist with the transferrability of the default values as the C_p data is garnered from wind tunnel tests on buildings of 3 storeys or less with square surfaces and 3 levels of site exposures.

IES Virtual Environment uses MacroFlo for bulk airflow predictions. A number of surface types (referred to as Exposure Types) are considered for a range of wind directions (i.e. angles of attack). The exposure types consider both surface orientation and degree of sheltering by nearby obstructions. The C_p values for the exposure types are based on the AIVC data mentioned above. A range of 66 exposure types are provided within MacroFlo with C_p values for 16 varied angles of attack (IES VE, 2007).

DesignBuilder is a front end interface for the EnergyPlus simulation engine, which has been coupled with the AIRNET bulk airflow module for zonal airflow predictions. Custom wind pressure coefficients in DesignBuilder (2005) can be entered by the user for wind incidence angles in 45° increments (i.e. 8 varied angles of attack) for each surface in the model. Default data for each surface is transposed to the model from the AIVC database of wind pressure coefficients as described previously

The relevancy of this approach can vary greatly depending on the complexities of the building, surrounding terrain and obstructions, as well as the modeller's ability to translate the default data appropriately to the building being studied. This derivation for C_p values is a good first level of approximation for basic design purposes but ideally these would be overridden with data specific to the application via CFD simulations or physical models tested in a wind tunnel. This is especially true for buildings greater than 3 stories in height.

CPCALC+

A hybrid prediction method has been developed by Grosso et al. (1995). Acknowledging that wall-averaged values of C_p usually do not match the accuracy required for multizone airflow models, Grosso et al. developed a numerical model (CPCALC+) to predict C_p values for any location on the building envelope. The algorithms they created calculate site-specific coefficients based on a parametric analysis of wind tunnel test results for a rectangular shaped building with flat or tilted roof for given conditions of terrain roughness, density of surounding buildings, shape ratios, and wind dirction. This method would likely provide an improvement over the method used by the two software tools mentioned above, but is still limited to low-rise buildings and building shapes that are close to rectangular forms.

PROPOSED APPROACH

Based on the available tools described above, we propose the following best-practice approach to natural ventilation design:

1. ***Outline of analysis:*** Identify the internal/external loads, specify the target flow and temperature conditions, and determine the range of flow rates required to balance.
2. ***Obtain site specific wind data:*** Meteorological information on the wind conditions at the site is necessary to accurately describe the wind speeds and direction the building is exposed to. This is a wide field in itself, which is not discussed in the present paper in detail. Instead the focus is on C_p values and airflow network models.
3. ***Obtain Cp values:*** As described above, the most accurate approach is to use specific wind tunnel data for the proposed building. If a

wind tunnel study is not feasible and it is appropriate for the project, estimates can be provided by experts. These estimates can be improved by exterior CFD studies.

4. ***Airflow network model***: Ideal for determining yearly performance of natural ventilation designs due to the ease in which one can evaluate a large number of opening arrangements, control strategies, construction materials, etc.
5. ***CFD study***: If an analysis of the detailed performance of internal airflows is required, particularly for elements such as thermal chimneys, wind towers, etc., a computational fluid dynamics study is needed.

CASE STUDY

An example case study of estimating C_p values is provided here for a laboratory and research building in eastern Canada. The C_p values were entered into the IES Virtual Environment whole building energy modelling software which was used for the natural ventilation study. Figure 1 shows an image of the IES VE model of the building. As can be seen, the building shape deviates strongly from a 3-storey rectangular building.

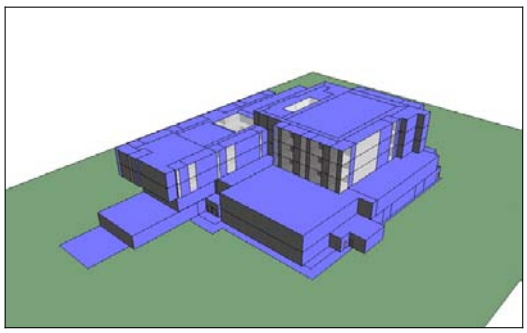

Figure 1: IES VE Model Rendering of Proposed Building

The study team had previously completed a wind tunnel study for a neighbouring building which incorporated very similar localized topology and surrounding obstructions. The model building was tested for an open/suburban profile (alpha=0.17) on a blank disk (no surrounding buildings). This data and experience of the wind engineer were used to develop estimates of the C_p values for the opening locations. Twenty-four external façade wind pressure zones were designated for the proposed building based on exposure, height and orientation (as shown in Figure 2). Wind pressure data from the wind tunnel testing were transposed on each of the 24 zones in order to approximate C_p values for 10° wind directional increments.

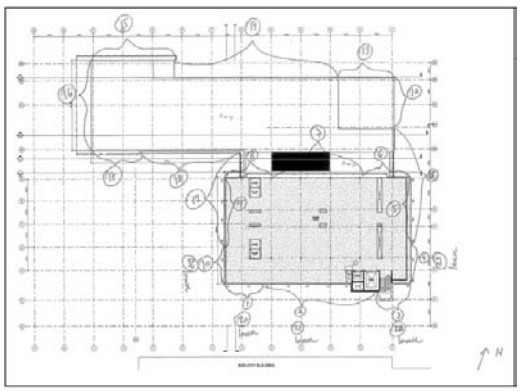

Figure 2: Cp Zoning Diagram of Building Exterior
(Background image courtesy of Kuwabara Payne McKenna Blumberg Architects)

The wind tunnel approximated C_p values are shown in Table 1 for a few selected angles of attack (0º, 90º, 180º, 270º) in the columns marked "Est". The values for each of the 24 zones are compared with default values available within IES VE. In order to provide adequate comparison, appropriate exposure types were selected as described in columns 2, 3 and 4. Each façade was assigned C_p values based on exposure type (exposed, semi-exposed, sheltered), wall ratio (rectangular long and short, cubic), and opening height (low-rise or < 3 storey and high-rise or > 3 storey). These exposures types were selected based on criteria as set out by the IES VE's MacroFlo Calculation Methods manual (IES VE, 2007).

It can be seen that there are significant differences between the two estimates. Average differences range from 28% for the 90º angle of attack case to 46% for the 270º case. The difference for specific cases exceeds 200% for some instances. Also of significance is that not only do the magnitudes of C_p predictions differ significantly for certain zones, but the sign is different as well. For zone 19 it can be seen that for an angle of attack of 0º the wind tunnel generated predictions give a negative C_p value (-0.51) while the IES predictions are positive (+0.39). The opposite is true for a 270º angle of attack (+0.53 for wind tunnel and -0.56 for IES). Reviewing Figure 2 it can be seen that zone 19 is located on the inner bend of the approximately "L-shaped" building. The shape of the building creates localized airflow patterns that are not accounted for in the default method created by testing on cubic building

shapes. A C_p variation from positive to negative is the difference between an opening having an inflow vs. outflow of air. As can be imagined, this will greatly alter the results of a natural ventilation analysis.

CONCLUSION

The major tools and wind pressure calculation methods essential to simulate natural ventilation design are described in this paper.

A best practice natural ventilation approach was proposed in which the varied methods of wind pressure coefficient derivation were prioritized. The best precision is achieved through scale model wind tunnel testing of the proposed building. Expert estimates based on data for other similar buildings can also improve the relevance of the C_p values to be used in airflow network model simulations. External flow modelling (CFD) can provide valuable additional information to the wind engineer providing a qualitative estimate for C_p values, thus improving the estimate.

To show the significance of C_p derivation a case study was presented comparing an expert estimate based on a wind tunnel test for a building in almost the same location, transposing site specific wind tunnel data to a proposed façade, to common practice airflow network derivation techniques. The case study showed that not only do the magnitudes of C_p values vary sifnificantly for the differing techniques, but also the prediction of whether the opening is in a positive or negative pressure location can differ. This can make the difference between air entering the building through an opening and exhausting.

The case study outlines that common airflow network C_p derivation techniques are reasonable for cubic shaped buildings but for buildings of more complex shape, and thus airflow patterns, more accurate prediction methods, such as wind tunnel testing, are recommended.

ACKNOWLEDGMENTS

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Table 1: Wind C_p as Predicted by Wind Tunnel Estimations (Est) and Zonal Airflow Model (IES)

	IES C_p Derivations			**Angle of Attack**											
Bldg Zone	***Exposure (1) High-rise***	***Exposure (2)***	***Wall***	***0º (Est)***	***0º (IES)***	***% DIF F***	***90º (Est)***	***90º (IES)***	***% DIF F***	***180º (Est)***	***180º (IES)***	***% DIF F***	***270º (Est)***	***270º (IES)***	***% DIF F***
1	(h/H=0.8)	exposed	long	0.36	0.65	81%	-0.68	-0.65	5%	-0.49	-0.28	43%	-0.30	-0.65	115%
2	(h/H=0.8)	exposed	long	0.58	0.65	12%	-0.56	-0.65	15%	-0.46	-0.28	39%	-0.50	-0.65	29%
3	(h/H=0.8)	exposed	long	0.36	0.65	81%	-0.32	-0.65	102%	-0.49	-0.28	43%	-0.66	-0.65	2%
4	(h/H=0.8)	exposed	short	0.50	0.65	30%	-0.60	-0.65	8%	-0.25	-0.28	12%	-0.63	-0.65	2%
5	(h/H=0.8)	exposed	short	0.49	0.65	33%	-0.57	-0.65	13%	-0.26	-0.28	8%	-0.70	-0.65	8%
6	(h/H=0.8)	exposed	long	0.38	0.65	71%	-0.66	-0.65	2%	-0.43	-0.28	35%	-0.31	-0.65	108%
7	(h/H=0.8)	exposed	long	0.62	0.65	5%	-0.52	-0.65	24%	-0.40	-0.28	30%	-0.52	-0.65	24%
8	(h/H=0.8)	exposed	long	0.37	0.65	76%	-0.32	-0.65	102%	-0.43	-0.28	35%	-0.70	-0.65	8%
9	(h/H=0.8)	exposed	short	0.53	0.65	23%	-0.66	-0.65	2%	-0.24	-0.28	17%	-0.55	-0.65	17%
10	(h/H=0.8)	exposed	short	0.52	0.65	25%	-0.63	-0.65	2%	-0.25	-0.28	12%	-0.62	-0.65	4%
11	(h/H=0.4)	exposed	short	0.56	0.39	31%	-0.65	-0.56	14%	-0.26	-0.27	4%	-0.72	-0.56	22%
12	(h/H=0.4)	exposed	short	0.32	0.39	20%	-0.56	-0.56	0%	-0.26	-0.27	4%	-0.76	-0.56	26%
13	(h/H=0.4)	exposed	long	0.33	0.39	17%	-0.71	-0.56	21%	-0.47	-0.27	43%	-0.26	-0.56	115%
14	(h/H=0.4)	exposed	long	0.58	0.39	34%	-0.48	-0.56	17%	-0.46	-0.27	41%	-0.48	-0.56	17%
15	(h/H=0.4)	exposed	long	0.31	0.39	24%	-0.27	-0.56	107%	-0.47	-0.27	43%	-0.74	-0.56	24%
16	(h/H=0.4)	exposed	short	0.48	0.39	20%	-0.71	-0.56	21%	-0.26	-0.27	4%	-0.64	-0.56	13%
17	(h/H=0.4)	exposed	long	0.32	0.39	20%	-0.74	-0.56	24%	-0.53	-0.27	49%	-0.24	-0.56	133%
18	(h/H=0.4)	exposed	long	0.53	0.39	27%	-0.51	-0.56	10%	-0.53	-0.27	49%	-0.45	-0.56	24%
19	(h/H=0.4)	exposed	short	-0.51	0.39	175%	-0.53	-0.56	6%	-0.45	-0.27	40%	0.53	-0.56	206%
20	(h/H=0.4)	exposed	long	0.32	0.39	20%	-0.74	-0.56	24%	-0.53	-0.27	49%	-0.24	-0.56	133%
21	(h/H=0.4)	exposed	long	0.53	0.39	27%	-0.51	-0.56	10%	-0.53	-0.27	49%	-0.45	-0.56	24%
22	(h/H=0.4)	exposed	long	0.29	0.39	33%	-0.27	-0.56	107%	-0.55	-0.27	51%	-0.71	-0.56	21%
23	(h/H=0.4)	exposed	short	0.31	0.39	24%	-0.67	-0.56	16%	-0.27	-0.27	0%	-0.61	-0.56	8%
24	(h/H=0.4)	exposed	short	0.34	0.39	13%	-0.61	-0.56	8%	-0.26	-0.27	4%	-0.69	-0.56	19%

News from IBPSA affiliates

IBPSA affiliates are asked to submit a report to the IBPSA Board each year to keep Board members informed about their activities and membership. These are too detailed to include in *ibpsa*NEWS, so affiliates have been asked to make their latest annual report available through their web sites, and this section includes only selected, recent news. Other news from affiliates is available from their websites:

	**IBPSA Australasia**	contact:	**Paul Bannister**
	**IBPSA Brazil**		**Nathan Mendes**
	**IBPSA Canada**		**Jeff Blake**
	**IBPSA China**		**Da Yan**
	**IBPSA Czech Republic**		**Martin Bartak**
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IBPSA-Australasia

An Australian standard for simulations?

One of the unique features of the simulation market in Australia is that a great deal of effort is being put into simulating buildings with the intent of representing the potential absolute performance in practice. This creates a series of unique challenges, which are being thrust upon a largely unprepared and often inexperienced simulation community.

This is further complicated by the fact that there are multiple conflicting simulation standards in operation - notably determined by the requirements of the National Australian Built Environment Rating System (NABERS), the Building Code of Australia and GreenStar. While to some extent these different approaches reflect different needs, there appears to be scope and some support for the concept of an Australian Standard for simulation, which would create a common thread and some quality assurance processes.

IBPSA Australasia President Dr Paul Bannister has been canvassing some of the key agencies involved and has received some support for this concept. "It's all rather early in the piece" Dr Bannister notes, "but there is I think an undercurrent of support. The challenge will be to get all the relevant parties around the table including some people with simulation expertise - thus far all of the existing standards have been the products of one or two people's expertise rather than representing the combined knowledge of the industry."

Dr Bannister has been investigating ways in which IBPSA Australasia can take a leading role in driving the creation of a Standard. "The key is to have some common processes so that the amount of rework of an individual simulation to enable compliance with NABERS, the BCA and GreenStar can be minimised. We also need to encourage people to use the simulations in a more inquisitive manner as well, rather than just as a compliance tool."

The problem as usual is funding. Dr Bannister has attempted to secure funding for some work towards creating some simulation training materials, with a specific view towards improving the representation of items like fans, pumps, chillers and boilers in simulation models. However, thus far no funding appears likely, leaving the industry with significant problems in terms of the quality of representation of such items in most simulation models.

"The rapid expansion of simulation as a tool in the Australian market means that there are many inexperienced modellers out there, making the mistakes that more experienced simulators were making 10 or 15 years ago. However, it is difficult to get recognition of this when the agencies with funding have relatively little understanding of the intricacies of simulation, and when to some extent the more experienced simulators are themselves trying to protect "their patch". I believe IBPSA needs to take a broader view about the need to up-skill the market, ensuring that high quality simulation is the norm rather than the exception."

Members with suggestions for how these barriers can be overcome are invited to contact Dr Bannister directly at **paul@xgl.com.au**.

IBPSA-Brazil

As previously done for the BS '07 Conference in China, IBPSA-Brazil will again award the best papers by graduate students from Brazil, and provide financial support to help them presenting the papers and attending the BS '09 conference. The exact amount and the number of papers that will be awarded will be established soon.

IBPSA-Canada

eSim2010

The IBPSA-Canada board has selected Winnipeg, Manitoba, as the next venue for their biennial eSim conference to be held from 18 to 20 May 2010. eSim2010 will be hosted by Manitoba Hydro in conjunction with the National Research Council of Canada (NRC). Visit **www.ibpsa.ca** for more information.

Travel grants to graduate students presenting papers at BS'09 Glasgow

IBPSA-Canada is pleased to announce the availability of travel grants for up to three full-time graduate students enrolled at a Canadian university who are presenting papers at Building Simulation 2009 in Glasgow, Scotland. Each award will be for a fixed amount of 1500$ Canadian to offset expenses related to conference participation. An IBPSA-Canada review panel will evaluate final paper(s) and other submitted documentation for students who submit their names for consideration before the application deadline of April 30, 2009. Please email **Jeff.Blake@nrcan.gc.ca** to obtain the application procedures.

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IBPSA-China

Two-day workshop: Green Building Design and Building Simulation

The Department of Building Services Engineering, Hong Kong Polytechnic University, with the endorsement of The US DOE Lawrence Berkeley National Laboratory (LBNL) and IBPSA-China, held a two-day workshop on Green Building Design and Building Simulation on April 17-18, 2009. The workshop was supported by The Hong Kong Institution of Engineers, Building Services Division and American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc., Hong Kong Chapter. The workshop was intended for architects, engineers, building officials, energy and environmental policy makers, students, researchers, and related professionals in the building industry. Attendants were presented with CPD certificates.

The workshop's main premise was that reducing building energy consumption would have significant positive impacts on global climate change and lessening our dependence on fossil fuel. Some of the questions addressed in the workshop were "What are green buildings and zero energy buildings? What are their differences and

what do they share in common? How to design them? Do they cost more? Are they more difficult to design? What energy efficient technologies can be applied to them?"

The first day focused on green buildings and zero energy buildings - their concept, history, current and future developments, the USGBC LEED rating systems, related building energy code and standards, and the challenges of zero energy buildings. Case studies were also discussed. The second day focused on building performance simulation, with sessions on available simulation programs, the introduction of EnergyPlus, and the use of EnergyPlus to evaluate design alternatives. Hands-on exercises with EnergyPlus were also included.

The instructor was Dr Tianzhen Hong, a scientist with the Simulation Research Group of the Environmental Energy Technologies Division of the US DOE Lawrence Berkeley National Laboratory. Dr Hong is also a registered mechanical engineer with the state of California, a certified energy manager with Association of Energy Engineers, and a LEED accredited professional with USGBC.

Prof. Jianlei Niu, Director of the Research Centre of Building Environmental Engineering, the largest research centre of building energy and environmental research in Hong Kong, plans to organize similar workshops in the future. He welcomes researchers from the building simulation community worldwide to give lectures and introduce the latest developments in building simulation to the industry in Hong Kong. Prof. Niu can be contacted at **Bejlniu@polyu.edu.hk**.

Workshop on Building Energy Efficiency and Simulation Tool Development

Kunming Airport

A workshop on building energy efficiency and simulation tool development was held on December 30th, 2008 in Tsinghua University to promote the use of building simulation. This was attended by around 20 people from design institutes, a software company and research institutes. Ten design projects which were developed using simulation in the design process were presented, including Kunming Airport (left) and the Tianjin International Financial Center project (right). Attendees also exchanged ideas and discussed the key bottleneck problems of using simulation in design processes. Guidelines on how to use simulation tools properly in design processes will be drafted and announced in the next workshop. Six papers from the workshop on the use of building simulation in practice will be published as a special issue of Journal of HV&AC (Chinese) in May.

Tianjin International Financial Center

Forthcoming event: Annual IBPSA-China Conference

IBPSA-China will hold its 3rd annual national conference in December 2009 in Beijing.

Around 100 delegates are expected. Conference topics will include:

- Building physics
- HVAC system simulation
- Human behaviors
- Advances in modeling
- Software development

IBPSA-England

Dejan Mumovic and Malcolm Cook, IBPSA-England

1st Low Carbon Buildings Symposium

Organised by IBPSA-England (**www.ibpsa-england.org**), CIBSE School Design Group (**www.cibse-sdg.org**), and CIBSE Natural Ventilation Group, the 1st Low Carbon Buildings Symposium in July 2008 brought together professionals from key industry and academic organisations in the UK. A total of 176 people attended this symposium focusing on design, operational performance and the future challenges related to low carbon buildings. The symposium has greatly increased the awareness of IBPSA England's aims and objectives. Following the event 62 attendees became members of IBPSA-England. This served to highlight a valuable role of advanced building simulation in building design. The presentation and discussion forum held during the symposium were recorded, and 14 multimedia webcasts have been created and hosted on the Low Carbon Buildings Directory (**www.lowcarbonbuildingsdirectory.org**) - see below - which also features news and information on low carbon buildings and sustainable building design.

Paul Eslinger, Regional Director of WYG, speaking about ways to reduce energy use in schools

The 2nd Low Carbon Buildings Symposium held in February 2009 focused on the delivery of zero carbon school buildings. More than 100 professionals attended this event and concluded that plans to make schools in England zero carbon will be a major challenge. Lack of understanding and skills at all levels, lack of knowledge, increasing complexity of school life, rising expectations, and lack of funding were highlighted as major barriers to the delivery of zero carbon schools. This symposium was organised jointly by IBPSA-England and CIBSE School Design Group. Nine multimedia webcasts have been created as a result of this symposium.

Low Carbon Buidings Directory

The Low Carbon Buildings Directory at **www.lowcarbonbuildingsdirectory.org** is an online educational tool supported by IBPSA-England designed to build a new alliance

of professional organisations, academics and practitioners who are willing to share knowledge and experience relating to the design and operational performance of low carbon buildings. All presentations on the Low Carbon Buildings Directory tackle one or more aspects of the complex interaction between the physical, environmental and sometimes social processes that underpin sustainable building design and engineering. Key outcomes are insights into effective design techniques and engineering technologies for low carbon buildings that can be used by students, architects and building services engineers. IBPSA-England and other partners look forward to continued input from any other organization willing to participate in the further development of this educational learning portal. See **www.ibpsa-england.org** for more details.

Student modelling competition

Members of the IBPSA England committee have put together a student modeling competition which runs between now and the BS09 conference in Scotland. The subject of the task posed is the use of computer simulation to devise a control strategy for a hybrid ventilation system in a three-storey office building in Glasgow, Scotland. So far about 15 entrants are confirmed. Further details are available from the conference website **www.bs2009.org.uk**. As this is the first time such a competition has been organized we would be interested to receive any feedback from IBPSA members about whether such a competition might become a regular feature of the bi-annual IBPSA conference.

IBPSA-Japan

Conference 2008

IBPSA-Japan's 2008 conference was held on November 28th, 2008 in Kyoto. The half-day event included a paper presentation session, a keynote speech introducing a new simulation program under development in Japan, and a board meeting. Twenty-five people attended, including ten students.

One peer-reviewed paper and eleven non peer-reviewed papers were presented, covering the fields of heating/cooling load simulation, building modeling, building services, commissioning and operation, and energy conservation. Discussions were conducted after each presentation in Japanese or English. After the presentations, Prof. Ishino, the former chairman of the IBPSA-Japan, gave a keynote speech in which he introduced BEST, a new simulation program under development in Japan. This is a comprehensive program which can simulate the energy consumption of building facilities, including HVAC systems, elevators, and lighting, from the planning/design stage to full operation.

During the board meeting the current financial conditions and budget for the next financial year were approved and the future operational policy of IBPSA-Japan was discussed. The board agreed that that membership of IBPSA-Japan should be free in future, that paperless electronic proceedings of events should be produced, and that members of IBPSA-Japan should be encouraged to submit papers to the Journal

of Building Performance Simulation and to Building Simulation as well as to IBPSA conferences. Prof. Yoshida, IBPSA-Japan's representative on the IBPSA board, also spoke about IBPSA's recent activities worldwide.

Despite its tight schedule, the conference was judged to be fruitful and successful. The full conference programme was as follows:

Session 1: Peer-reviewed paper (Presentation 15 min, Q&A 5 min)

Siqiang Lu, Kazuo Emura, and Norio Igawa. Comparison of Standard Year Weather Data of 5 Cities in China by Simulation.

Session 2: Non peer-reviewed papers (Presentations each 10 min plus 4 min Q&A)

- Song Pan, Mingjie Zheng, and Harunori Yoshida. Commissioning of a Coupled Earth Tube and Natural Ventilation System at the acceptance phase by measurement and a coupled CFD analysis
- Eikichi Ono, Harunori Yoshida, and Fulin Wang. Research of retro-commissioning heat source system of district heating and cooling system
- Zhaoming Zhang, Harunori Yoshida, Masato Miyata, Hirotake Shingu, and Hirokazu Tashiro. Research on optimal operation and design of cooling heat source equipment by simulation
- Yoshidtaka Uno, Reiko Kubara, and Yoshiyuki Shimoda. Study on the energy saving potential of cooperate operation between heat source plant and building HVAC system in district heating and cooling system
- Yujiro Hirano, Hidefumi Imura, Tetsuro Kawada, and Yukiko Yoshida. Exergy analysis of the air-conditioning system in an office building
- Mingjie Zheng and Song Pan. Development of a simulation tool for calculating maximum allowable cooling hour in closed type cooling tower
- Mutsuo Honma. The study on judgment of cloudy for the purpose of application to blinds' slat angle control system
- Yushi Iwai, Jun Tanimoto, Ri Hagishima, and Yukiko Isayama. Total utility demand prediction considering variation of occupants' behavior schedules
- Tomo Okamura, Yoshiyuki Shimoda, Youhei Yamaguchi, and Yukio Yamaguchi. The effect of introducing effective energy saving measures in each household in Japanese residential sector
- Shintaro Azuma, Youhei Yamaguchi, and Yoshiyuki Shimoda. Selection of parameters affecting energy demand of office building and application in modeling the energy demand at the city scale
- Youhei Yamaguchi and Yoshiyuki Shimoda, Prototypical building model of commercial sector buildings

Dr. Yamaguchi presenting his paper on the standard model for commercial buildings

Prof. Yoshida asking a question on a presentation

Prof. Ishino introducing BEST, a new simulation program under development in Japan

Session 3: Keynote speech

Hisaya Ishino, Introduction of the BEST Program

Session 4: IBPSA-Japan Board Meeting

Further details of the conference are available at **http://www.consortium.or.jp/contents_detail.php?co=cat&frmId=593&frmCd=14-1-0-0-0**.

IBPSA Netherlands + Flanders

2008 event: Building simulation - the practice and trends

IBPSA Netherlands and Flanders held their 2008 Event at the Technical University of Eindhoven on 9 October 2009. Attended by around 80 professionals, it was divided in two parts: a symposium and a conference. In the symposium an overview of different views of building simulation was given by several national and international speakers including Rgd, ARUP, and TNO University of Liege. This covered building simulation through the eyes of customers and building simulation as a tool in commissioning of buildings. The conference part showed that there is a practical role and applications for building simulation in the Netherlands.

Building simulation has now been available for many years and during this period the increasing power of computers has helped tremendously in reducing computational time and enhancing the degree of complexity of problems that can be solved. But a question still remains: what is building simulation in practice, and is simulation becoming an ingrained habit in the building process? Building simulation has not yet achieved this general level of acceptance, and it is often used only to check parameters such as comfort and temperature levels. Recently, it has also started to be used for investigating fire and heat transport. On an international level there is a trend towards evaluating building energy use as part of sustainability analysis.

Trends in building simulation are still developing, but widespread use in practice is still in its infancy. More attention should be given to its correct use, particularly in the accuracy of input parameters, the numerical approach and the interpretation of results.

At the end of this event it was clear that building simulation has a large and fruitful future ahead but it still needs a much higher investment of time and money to achieve a broader and wider application. IBPSA Netherlands and Flanders hope to help building simulation to become a standard part of the building process, well implemented, and understood by all the different parties involved. That must be our mission.

IBPSA-Switzerland

Gerhard Zweifel

IBPSA Double Session at National Conference "Statusseminar"

A successful IBPSA double session with a total of 10 papers was held in one of the most important Swiss national conferences on energy and environmental research in buildings, the "Statusseminar Energie- und Umweltforschung im Bauwesen" in Zürich on Sep 12, 2008. This conference is organised bi-annually by IBPSA-Switzerland's mother organisation, brenet (Building and Renewable Energies Network of Technology). The IBPSA-Switzerland general assembly was also held during the conference. Conference proceedings (partially in English) can be found at **www.brenet.ch/2008_alle.php**.

HVAC Designer Seminar with Simulation Focus

An HVAC designer seminar organised by the Lucerne University of Applied Sciences and Arts in cooperation with AFC Company and co-sponsored by IBPSA-Switzerland was held in Horw on March 24th, 2009. The program, focusing on simulation, included contributions from IBPSA-Switzerland board members Alois Schaelin and Gerhard Zweifel as well as from IBPSA Germany president Christoph van Treeck. The handouts are available at **http://weiterbildung.hslu.ch/technik-architektur/kurs.asp?kid=391&m=10&page_no=1&tid=&search=Weiterbildungskurse**.

1st Swiss Building and Urban Simulation Conference

The first stand alone national conference on building and urban simulation organised by IBPSA-Switzerland is planned to be held on November 6th, 2009, at the Lucerne University of Applied Sciences and Arts in Horw. It will feature Professor Christoph Reinhart from Harvard and Prof. Dirk Müller from RWTH Aachen as keynote speakers. A selection of good quality papers from the conference will be submitted to the Journal of Building Performance Simulation for its special edition issue. For further information visit **www.ibpsa.ch**.

IBPSA-UAE

Launching IBPSA-UAE official website

IBPSA-UAE launched its official website in January 2008 coinciding with the Environment 2008 exhibition that took place in Abu Dhabi, UAE, which is considered one of the biggest events in the region. For more information, visit **www.ibpsauae.ae**.

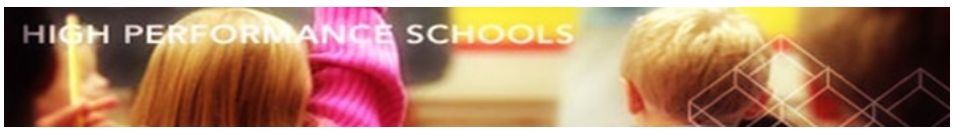
IBPSA UAE in World Renewable Energy Congress

IBPSA-UAE board members Dr. Khaled Al-Sallal and Arch. Laila Al-Rais have presented two research papers in the World Renewable Energy Congress, WREC X, in Scotland last July 2008 that involved performance analysis of case studies in the UAE using simulation.

The first paper entitled "Visual Quality Issues in Classroom Design in the UAE" mainly covered daylight quality issues in educational buildings. The study focused on analysis of visual performance and quality issues in the teaching zones of schools located in the UAE. The methodology depended on data collection and analysis of design information obtained from architectural drawings of case studies and design requirements and guidelines set by the relevant governmental bodies. It also included information obtained from site visits and photography.

The second paper entitled "Investigating airflow in traditional urban context in Dubai using CFD" covered natural ventilation issues in urban fabrics. The main aim of the study was to investigate passive cooling performance in traditional urban contexts in the harsh hot climate of the UAE, more specifically in the hot humid climate of the city of Dubai. The study implemented a Computational Fluid Dynamics (CFD) methodology using PHOENICS with its solver EARTH. Three cases were simulated for Al-Ras area in

Dubai with laminar and turbulent wind flow. The standard k-ε model was used as the turbulence model without any changes in the coefficients setup of the commercial code. (For more information visit **www.wrenuk.co.uk**.)



Student Project from UAE University

Introduction

The UAE has recently adopted new policies towards the use of more renewable energies that would help to save the environment and natural resources for future generations. This graduation project was proposed as a response to the new green building policy in the UAE. It was done by Najat Al-Gaithy; an architectural female student who graduated from UAE University last Spring 2007/2008, and under supervision of Dr. Khaled A. Al-Sallal, an associate professor of Architectural Engineering, UAE University.

Objective

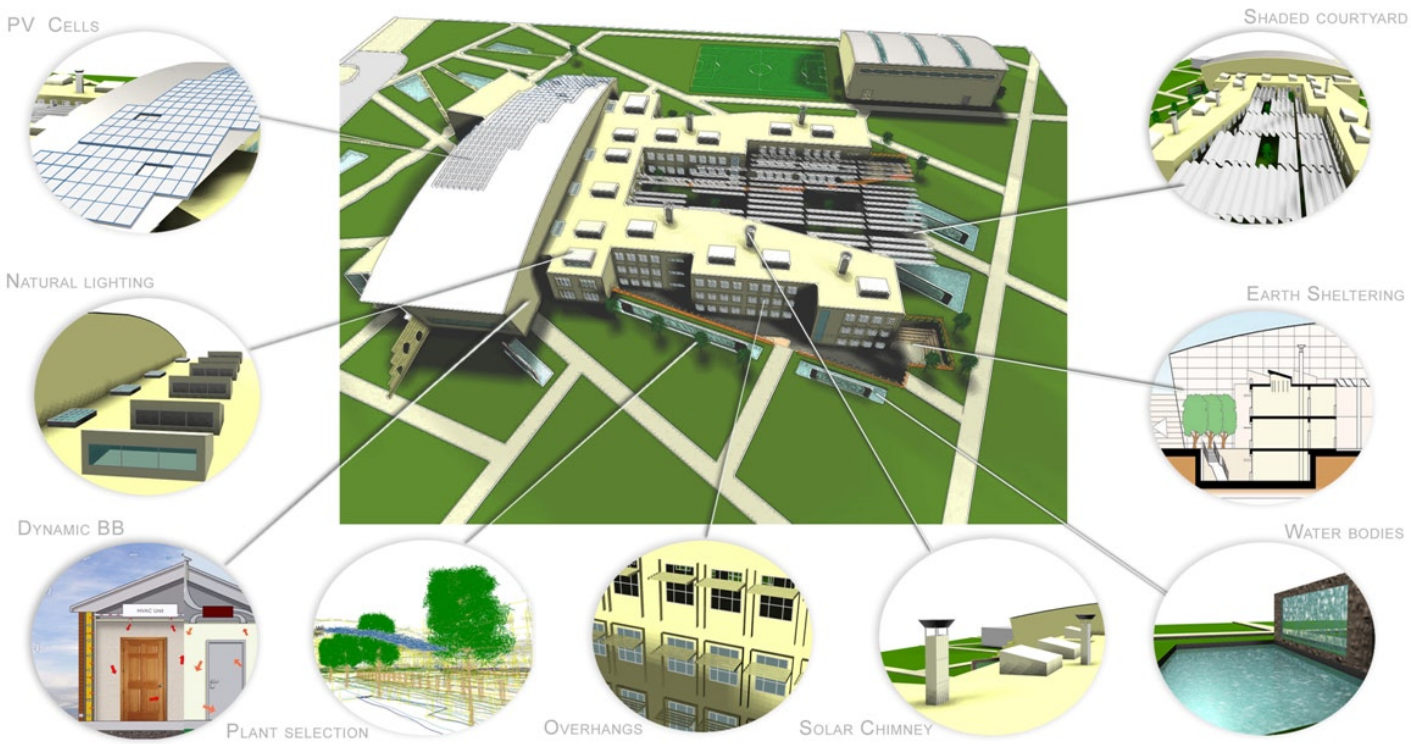
The idea of this project is to design a sustainable high performance school that can be used as a "prototype" for future schools in the desert region of the UAE. High Performance School refers to the physical facility that is not only well-designed and energy efficient, but also healthy, comfortable and well lit so that the building can enhance student performance and make education a more enjoyable and rewarding experience. In this sense, a sustainable school not only embraces the concept of sustainability but is, in itself a teaching tool for sustainability.

Design

From conceptualization to design development, creating a sustainable school based on functional, environmental, and socio-cultural factors was considered. The process started from 'sustainable form' configuration and site planning, then the design of windows and a smart building skin, followed by the design of passive daylighting and cooling systems, and finally the integration of renewable energy systems. A notched form with a central courtyard, open from W-NW side, was chosen to achieve two environmental benefits: first, to receive the cool breeze coming from the neighboring oasis in the northwest direction; and second, to maximize exposure to north daylighting and the oasis view while minimizing the undesirable west sun. This required placing the classrooms inside elongated masses with long sides oriented to north and south. With this form's design, the building's structure was highly shaded

and passively cooled; while the classrooms and other educational spaces had the chance for proper daylight access. For further improvement, the courtyard was also shaded by plants and a louvered shed; which helped to increase shading and filter natural light. Trees were also used to shade the west walls of the building; and the service spaces were used as thermal buffer zones on the west sides of the building. The other spaces that have strong connection to the school visitors, such as the community spaces and the administration, were placed in a mass that is parallel to the main street to give a landmark façade for the school. This mass also acted as a functional circulation connection and control area of the two other masses that enclosed the classrooms.

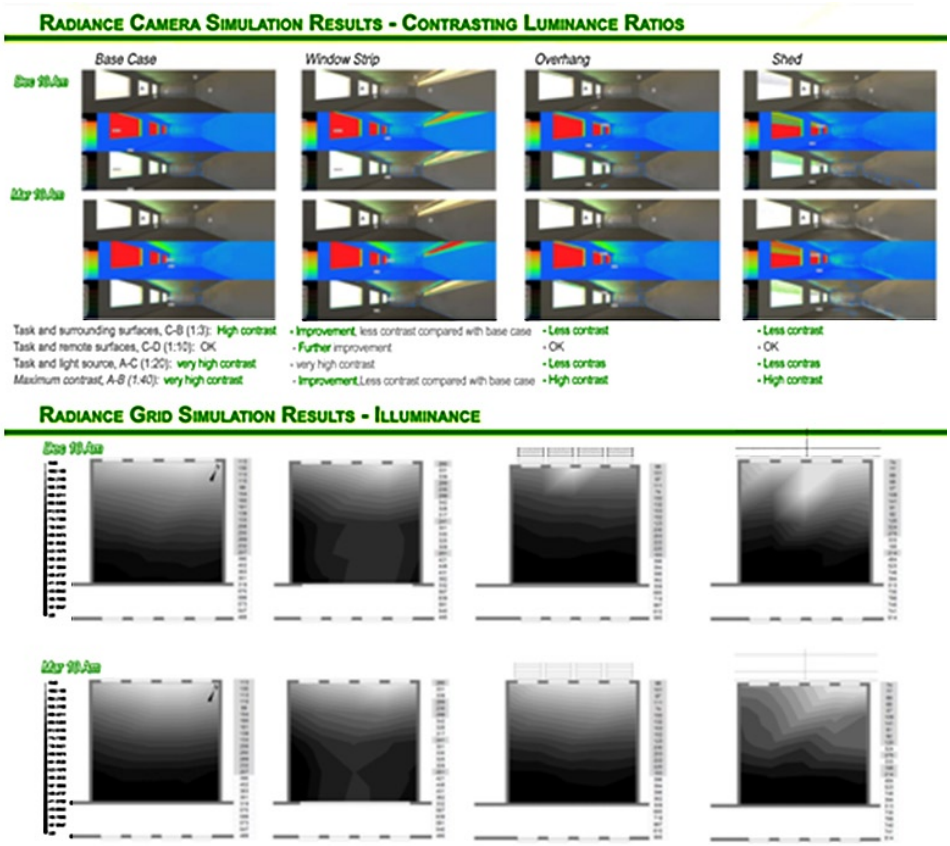
Designing the classrooms to rely entirely on daylighting and provide a proper luminous environment for students was a lengthy task that required evaluating the performance of the classrooms using simulation (see section Daylighting Simulation below.) The classrooms were provided with solar chimneys that assisted in drafting the oasis breeze inside the building to improve comfort through natural ventilation. The roof of the central activity building was provided with photovoltaic cells to generate power; this helped to reduce building energy consumption and CO2 emission.



Performance - Daylighting Simulation

The performance of several daylight and shading systems such as windows, window strips, roof monitors, tree shading, and a louvered shed, as well as their combinations, were simulated using Radiance. The simulations included contrasting luminances and illuminance levels. Based on the results, a combination that included North windows with 20% glazing area of the entire north wall and external shading using Neem trees,

along with high strip windows on the south side, were selected for the lower floors. For the top floor, roof monitors were used as an additional system to enhance the uniformity of light distribution. A few of the results are shown below.



IBPSA-USA

The IBPSA-USA chapter had a busy 2008 and will continue to be an active group in 2009. We take this opportunity to call attention to the new era here in the U.S. We're all excited; it's a great time to be a simulationist. At the board level this past year we organized the SimBuild2008 conference in Berkeley, California. Papers and presentations are available at **www.ibpsa.us/simbuild2008/index.shtml**. Refer also to the SimBuild2008 article in this newsletter (below). IBPSA-USA also elected new officers. The participation in IBPSA-USA at the domestic level increased significantly over the past 8 months. Following SimBuild2008, several local city chapters sprouted across the country in Portland, Houston, Chicago, San Francisco and the New York City affiliate chapter (**www.ibpsanyc.com**). The IBPSA-USA board is working with these local chapters to formalize their role within the larger IBPSA community. Our semi-annual meeting and banquet in Chicago in January was a success with a healthy turnout (photos left). The increase in participation represents a significantly new interest in building simulation and modeling. As a group we are proud to share this exceptional news with the international simulation community.

Currently, the IBPSA-USA board is focused on two projects in parallel. The first is preparing for the SimBuild2010 conference. Given the healthy participation at the 2008 conference we anticipate an even larger turnout for the 2010 conference. One option under consideration is to host the conference in New York City with the assistance of the New York City local chapter. Look for updates and calls for papers on our website in the coming months. **www.ibpsa.us**.

Late last week efforts on the second project solidified when the board submitted a proposal to the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Certification Committee. This proposal is to develop the first building simulation modeler certification examination with ASHRAE. The ASHRAE committee is responsible for developing, implementing, and monitoring ASHRAE credentialing programs and is expected to create a sub-committee to develop the examination itself as a first step. The anticipated logistical outcome of this project is to have a standardized building simulation modeler certification program that can be administered internationally at testing centers. More importantly however is the need to recognize qualified energy modeling experts in the community and set the minimum qualifications. We anticipate that this certification program will address the industry's call for accountability, accuracy, and expertise in the sector. Also under consideration by the USA board is the opportunity for IBPSA-USA to co-sponsor a test preparation program with the ASHRAE Professional Development Committee.

IBPSA-USA Board

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Michael Brandemuehl, Harvey Bryan, Brian Coffey, Greg Dobbs, David Eldridge, Peter Ellis, Phil Haves, and Tim McDowell.

SimBuild 2008 National Conference

IBPSA-USA's highlight of 2008 was its SimBuild2008 conference. This was the third highly successful national conference on building simulation July 30 - Aug 1, 2008 at the Clark Kerr Convention Center on the campus of the University of California, Berkeley. The conference attracted over 160 registrants, which includes some 34 student participants. Countries represented from outside the U.S. were Australia, Belgium, Bangladesh, Canada, China, Germany, India, Ireland, Korea, New Zealand, Pakistan, and the UK. There were 35 peer-reviewed technical papers, 31 seminars and 3 plenary speeches presented. Training workshops by various software vendors were offered in both pre- and post-conference sessions.

IBPSA-USA awarded 34 traveling/housing scholarships to the students, three best-poster awards to students, a best paper award, a young contributor award, two lifetime achievements awards, and a practitioner award.

PDF copies of all technical papers can be downloaded from the conference web site at **www.ibpsa.us/simbuild2008/**, which also has PDF copies of most of the PowerPoint presentations made at the conference. In the near future, IBPSA-USA plans to add all papers to its home page from the first two conferences held at the University of Colorado and MIT.

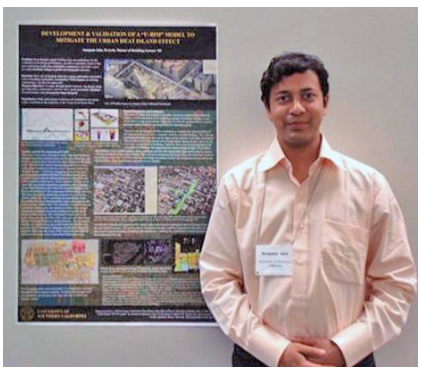
The 3-day conference gave participants a very rewarding opportunity for scholastic, social and technical interfacing, with lots of good food and housing.

Board meeting over lunch

Keynote address by world-renowned scientist Art Rosenfeld

Valuable interactions with students

Faculty exchange of ideas was enhanced by the beautiful weather



Best Poster 1st Place Award Winner, Anupam Jaim

Other news from around the globe

Belgium Air Infiltration and Ventilation Centre (AIVC): IEA ECBCS Annex 5

www.aivc.org/index.html

This Centre provides over 140 AIVC publications on air infiltration and ventilation, over 3600 papers on air infiltration and ventilation, over 18000 references on air infiltration and ventilation, and free online access to AIVC publications and databases for Belgium, France, Germany, Greece, Netherlands, Norway and USA. To access AIVC publications visit **www.aivc.org/frameset/frameset.html?../publications/publications.html~mainFrame**.

Building simulation makes upcoming Delhi International Airport safer

If you feel safer at the upcoming international airport at Delhi, there is a company in building simulation to thank. The company has contributed to the airport's ability to deal safely with two critical calamities: earthquake and accidental fire. The company, Mechartés Researchers Pvt. Ltd. (**www.mechartes.com**), has designed the airport's ventilation system to deal with smoke in a fire and also designed seismic restraints for equipment in the event of an earthquake. An advanced CFD (Computational Fluid Dynamics) tool has been used in the airport to see how the smoke would develop and propagate in case of a huge fire in different areas of the airport. Using this simulation method, it has been made sure that the ventilation system would start venting the smoke out of the airport as soon as the fire breaks and keep visibility inside the airport in good condition so that the occupants have enough time to exit to the designated safe areas.

The airport is also equipped to deal with earthquakes of intensity up to 7.5 on the Richter scale. The airport has been designed such that not only would the structure remain intact in case of an earthquake, but all the critical equipment in the airport would also remain functional. Mechartés has simulated the performance of vibration isolators and seismic restraints that can absorb the vibration induced due to an earthquake. Using simulation results, these isolators and restraints have been designed for various equipment like ducts, chillers, Air Handling Units, and motors as per International Building Code (IBC) guidelines so that they would not be uprooted from their place in the event of an earthquake. These restraints solve the dual purpose of keeping the equipment functional after the calamity and also avoiding human casualty due to the equipment hitting the occupants. "We had to rely on experience and rule of thumb for these fundamental design needs. Now with the advent of advanced simulation tools we can be much more confident of our designs. " remarks Prof. C.V. Ramakrishnan, chairman of Mechartés. For more detailed information and updates on the project contact Shishir Gupta, CEO, Mechartés Researchers.

IBPSA Sustaining Members

Sustaining members of IBPSA are those individuals or organizations that provide financial support to IBPSA at the level of US$500 or more per year. To learn about sustaining membership, please contact one of the IBPSA officers shown in this newsletter.

	US - DOE **United States Department of Energy** **1985-2009**
	American Society of Heating, Refrigerating & Air-Conditioning Engineers **2003-2009**
rehva	**REHVA** **Federation of European Heating & Air-Conditioning Associations** **2003-2009**
	IEA - ECBDS **International Energy Agency - Energy Conservation in Buildings & Community Systems** **2005-2009**
清華大學 Tsinghua University	**Tsinghua University** **2007-2009**
HVAC&R	**China HVAC&R Society** **2007-2009**

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Eindhoven University of Technology, Netherlands

IBPSA Secretary and Regional Affiliate Liaison

Drury Crawley
US Department of Energy, USA

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For additional information about IBPSA, please visit the Association's web site at **www.ibpsa.org**. For information on joining, contact your nearest regional affiliate.

IBPSA's mailing list has been consolidated into another listserver known as BLDG-SIM, which is a mailing list for users of building energy simulation programs worldwide, including weather data and other software support resources. To **subscribe** to BLDG-SIM, to unsubscribe or to change your subscriber details, use the online forms at **http://lists.onebuilding.org/listinfo.cgi/bldg-sim-onebuilding.org**.

To post a message to all members, send email to **bldg-sim@lists.onebuilding.org**.

The BLDG-SIM list is provided by GARD Analytics. If you have any questions, please contact the list owner Jason Glazer at jglazer@gard.com or +1 847 698 5686.

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(continued on next page)

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Past Presidents of IBPSA:
1987-1991 (5 years) Ed Sowell, USA

1992-1993 (2 years) Dan Seth, Canada

1994-1997 (4 years) Joe Clarke, Scotland

1998-1999 (2 years) Larry Degelman, USA

2000-2001 (2 years) Roger Pelletret, France

2002-2005 (4 years) Jeff Spitler, USA

Privileges and Obligations of IBPSA Members and Affiliates

All members are encouraged and entitled to take part in the activities of IBPSA, subject to constitutional or special provisions by the management of IBPSA. The aims of the activities are to disseminate information and aid the progress of IBPSA's efforts and image.

All members have the right to participate in meetings of IBPSA, but the right to vote is subject to the provisions for voting as contained in the present By-Laws. Members holding their membership through an Affiliate are not eligible to vote if the Affiliate has not submitted its membership roster to the Secretary of IBPSA. Affiliates, therefore, need to keep their membership rosters up to date and communicate them to the Secretary.

All members joining IBPSA must undertake to observe the IBPSA constitution and By-Laws and all obligations arising from them. They must also accept the obligation to contribute to the accomplishment of the activities of IBPSA according to their particular competence.

Any member may submit any communication for consideration at a General or Special Meeting of IBPSA or the Board of Directors. The Board will indicate its decision on the proposals within a reasonable timeframe that allows for an IBPSA Board meeting, either in person or by e-mail.

Affiliates are entitled to appoint one representative to the Board and take part in activities of IBPSA. Affiliates, upon joining IBPSA, must undertake to observe the IBPSA constitution and By-Laws and all obligations arising from them. Special obligations of Affiliates include annual notification to the Secretary of IBPSA of the following items:

1 the name of the Affiliate's board representative
2 the Affiliate's membership roster
3 reports of meetings and/or conferences held by the Affiliate, and
4 other information or reports requested by the Board.

Resignation and Termination

Affiliates wishing to terminate their affiliation may do so at any time subject to 90 days notice. Notice of termination must be transmitted in writing to the Secretary. If all communications from an Affiliate to the Board have ceased for a period of two years prior to any Board meeting, that Affiliate will be considered to have resigned.

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CALL FOR PAPERS

New to Taylor & Francis for 2008

Journal of Building Performance Simulation

Official journal of the International Building Performance Simulation Association (IBPSA)

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Taylor & Francis would like to invite you to submit your article to *Journal of Building Performance Simulation*

The ***Journal of Building Performance Simulation*** (***JBPS***) is the official journal of the International Building Performance Simulation Association (IBPSA). IBPSA is a non-profit international society of computational building performance simulation researchers, developers, practitioners and users, dedicated to improving the design, construction, operation and maintenance of new and existing buildings worldwide.

The ***JBPS*** is an international refereed journal, publishing only articles of the highest quality that are original, cutting-edge, well-researched and of significance to the international community. The journal also publishes original review papers and researched case studies of international significance.

The wide scope of ***JBPS*** embraces research, technology and tool development related to building performance modelling and simulation, as well as their applications to design, operation and management of the built environment. This includes modelling and simulation aspects of building performance in relation to other research areas such as building physics, environmental engineering, mechanical engineering, control engineering, facility management, architecture, ergonomics, psychology, physiology, computational engineering, information technology and education. The scope of topics includes the following:

- Theoretical aspects of building performance modelling and simulation.
- Methodology and application of building performance simulation for any stage of design, construction, commissioning, operation or management of buildings and the systems which service them.
- Uncertainty, sensitivity analysis, calibration, and optimization.
- Methods and algorithms for performance optimization of building and the systems which service them.
- Methods and algorithms for software design, validation, verification and solution methods.

Submissions

Manuscripts will be considered on the condition that they have been submitted only to ***Journal of Building Performance Simulation***, that they have not been published already, and that they are not under consideration for publication or in press elsewhere. All submissions should be in English. Papers for submission should be sent to the Editors at j.hensen@tue.nl. For full submission details, please see the journal's homepage www.informaworld.com/jbps and click on the "Instructions for Authors" tab.

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Building Simulation 2009

**University of Strathclyde,
Glasgow
27th – 30th July**

**11th International Building
Performance Simulation Association
Conference and Exhibition**

www.bs2009.org.uk

Welcome to Glasgow

Day	Am	Pm	Evening
Monday 27/07/09	Registration opens	Formal opening conference, keynote speeches.	Civic Reception Glasgow City Chambers
Tuesday 28/07/09			City tour (walking)
Wednesday 29/07/09	Main conference: plenary and parallel sessions, poster sessions and exhibitor displays. (Accompanying persons' tours)		Conference Dinner Barony Hall – University of Strathclyde
Thursday 30/07/09			Conference close Board Meeting
Friday 31/07/09	Technical tours and training courses		

Glasgow: Scotland with style™

We are delighted that The University of Strathclyde in Glasgow has been selected to host the 11th International Building Performance Simulation Association Conference and Exhibition in 2009.

With regard to Architecture and Engineering Design, the city has a longstanding reputation for innovative design and invention and has three Universities that include two schools of architecture, and a reputation for engineering that is second to none. In particular, over the past thirty years, Scotland has built up a strong reputation in the field of simulation research, development and technology transfer, through commercial and academic channels. Through IBPSA Scotland, and the University of Strathclyde, this knowledge and technology transfer work is developing rapidly and industry interest is growing, and so it is fitting that the conference should take place at Strathclyde.

As Scotland's largest city, Glasgow offers direct access from over 13 European cities and 5 transatlantic destinations. In addition there are 52 return flights per day from London. The city is well served by three airports: Glasgow International Airport is 10 minutes drive from the centre with a regular bus service, Glasgow Prestwick Airport is 23 miles south west of the city with a direct rail link (journey time 30 minutes) and Edinburgh Airport is located 45 minutes (35 miles) from Glasgow city centre.

Culturally, Glasgow has an unrivalled choice of museums, theatres, parks, science centre and shopping, set within some of the finest Victorian architecture in Europe. In addition, Glasgow has a worldwide reputation as a welcoming city and is firmly established and experienced as a major centre for conferences and international events.

Within a 30 minute drive from the city centre, visitors can experience the beautiful scenery of the lochs, mountains and castles of Scotland and the historic capital city of Scotland, Edinburgh is less than one hour away. This allows us to offer many interesting options for accompanying persons' programmes and technical tours – from the 'Whisky Trail' to the best golf courses in the world, to the much publicised Scottish Parliament building, designed by the late Spanish architect, Enric Miralles.

Conference Topics

Papers will be sought in the following areas:

1. **Advances in building physics:** heat, air, moisture, radiation and sound transfer modelling relating to building structure and systems.
2. **Human aspects:** comfort (acoustic, visual and thermal), health, productivity, indoor air quality, interaction with control systems.
3. **Building services:** lighting, heating, ventilation, air-conditioning, fire/smoke control, cold and hot water supply.
4. **Commissioning and operation:** building energy management, building control and optimisation, fault detection and diagnostics, and condition monitoring.
5. **Energy capture and generation:** modelling of renewable energy devices/ systems, thermal storage (including phase change materials), decentralised generation (e.g. CHP, district heating and cooling).
6. **Advances in application:** use in building codes and regulations, modelling of novel designs, risk management, simulation use in policy formation and strategic planning.
7. **Validation and calibration:** novel methods, applications and user certification.
8. **Software issues:** interoperability, teaching, user interface design, open source initiatives and internet based services.
9. **Simulation in design practice:** high quality case studies of modelling used in design.

University of Strathclyde

The University of Strathclyde was founded in Scotland in 1796 (as the Royal College of Engineering), to make higher education available to all, and to combine excellence with relevance. In fulfilling this mission in today's world it aims to:

Contribute to the advancement of the knowledge society, to social cohesion and to the quality of life in Scotland, and in the wider national and global community;

Generate, through excellence in research and scholarship, new ideas, knowledge and skills to create opportunities for individuals and society;

Provide high-quality education to all of its students, regardless of background, inspiring them to develop to the full their abilities, and creating outstanding professional and creative people;

Offer the opportunities for all staff to develop their full potential, and contribute fully to the achievement of the University's Vision.

Strathclyde is one of the top UK universities, blending tradition with a dynamic, progressive approach to teaching and learning.

Accommodation

Accommodation will be offered on campus at the University and in a number of top class hotels within 15 minutes walking distance of the conference venue.

The University of Strathclyde has its own campus village in the heart of the city with over 1000 rooms on site and a further 500 within close walking distance, mainly in the fashionable Merchant City. All student accommodation has access to an advanced computer and information network 24 hours a day and every study bedroom has full network access.

Currently we are holding rooms in the following hotels all within 15 minutes walk from the city centre campus. Further details are available on the conference website.

Accommodation	Star rating
Millennium Hotel	4
Holiday Inn Theatreland	4
Express by Holiday Inn Theatreland	3
Premier Travel Inn George Street	3
Express by Holiday Inn Riverside	3
University of Strathclyde	En suite

Conference Location

The conference will be held in the John Anderson Building on the University campus in the centre of Glasgow. The main auditorium seats 450 people, and there are adjacent lecture rooms for parallel sessions, and space for poster and exhibition displays.

Organising Committee

Conference Chair: Lori McElroy
Co-Chair: Paul Strachan
Industry Liaison: Joe Clarke
Software demo/training courses: Jon Hand
Sponsorship/ exhibitions: Jeremy Cockroft
Website: Kim Jaemin and Nick Kelly
Secretarial support/ Accompanying persons' programme: Kathleen Whyte
Conference Support: ESRU and Sust.

Scientific Executive Committee

Chair: Paul Strachan
Co-chair: Nick Kelly

Members
Fried Augenbroe, Ian Beausoleil-Morrison
Michael Donn, Jan Hensen, Roberto Lamberts,
Jeff Spitler, Terry Williamson,
Harunori Yoshida, Yingxin Zhu

Scientific Committee

The Scientific Executive Committee will nominate approximately 150 international reviewers.

Conference Theme

The conference theme is to promote the use of computer based simulation of the built environment in research and practice. Conference topics may be addressed at different levels: from single systems through buildings to urban and regional scale models, and at different stages of building life cycle: from concept design through building commissioning and operation to demolition.

Exhibition

The Anderson cluster includes various exhibition spaces that can be used for commercial exhibits and software demonstrations. This will provide excellent opportunities for any institution or company to promote their simulation services or products.

Accompanying Persons' Programme

A varied program will be arranged for accompanying persons drawing from Scotland's rich historical and contemporary culture. Example tours could include:

- Glasgow's galleries and museums including the Lighthouse, the Burrell Collection, Gallery of Modern Art, the People's Palace, Glasgow Science Centre and Kelvingrove Museum and Art Gallery;
- Edinburgh Castle;
- Visit to a crystal factory;
- Stirling Castle, Wallace monument and the site of the Battle of Bannockburn;
- Dumgoyne whisky distillery, (tour and whisky tasting!);
- and of course shopping in the best shopping centre in the UK outside of London.

We are confident that we can offer an experience of Scotland that is second to none.

Technical Tours

Many local businesses use simulation as an integral part of the design process. The technical tour will focus on two iconic buildings that took advantage of this in their design:

- The Scottish Parliament Building in Edinburgh (designed by Spanish architect Enric Miralles);
- A visit to the Lighthouse – Glasgow's Centre for Architecture and the City (designed in 1895 by Charles Rennie Mackintosh).

Dates

The conference will be held from the 27th to the 30th July 2009.

Deadline for submission of Abstracts	1 September 2008
Notification of abstract acceptance	1 November 2008
Deadline for full paper	1 February 2009
Notification of paper review	1 April 2009
Deadline for revised paper	15 April 2009
Deadline for final formatted papers	22 April 2009
Final acceptance notification	1 May 2009
Deadline for conference pre-registration	15 May 2009
Conference	27-30 July 2009

Glasgow · Glasgow: Scotland with style™ · SUST. The Lighthouse on Sustainability · Scottish Executive · ESRU · Scottish Energy Systems Group · The Lighthouse Scotland's Centre for Architecture, Design and the City · University of Strathclyde