Detailed Curriculum Vitae
Bass ABUSHAKRA, Ph.D.

4737 Sycamore St.
Greendale, WI 53129
Tel: 414-277-4551
Email: abushakr@msoe.edu

Citizenship American Citizen

Career Interests

Contribute in the Areas of Building Science and Energy Modeling and Analysis with both Forward Simulations and Data-Driven Modeling, Net-Zero Energy (NZE) Buildings, Distributed Energy Resources Systems (DERs), Sustainability, Renewable Energy, Energy Efficiency Technologies, and Indoor Environmental Quality.

Educational Credentials

Degrees:

Ph.D., Mechanical Engineering, (June 2000)
Texas A&M University,
College Station, Texas, USA
Dissertation:
"*Short-term Monitoring Long-term Prediction of Energy Use in Commercial and Institutional Buildings: The SMLP Method*"; an inverse method of energy analysis in existing commercial and institutional buildings, requiring short-term monitored data (2 weeks of hourly data) and enabling accurate long-term prediction (whole year).
Ph.D. Advisor: Dr. David Claridge, Professor, Mechanical Engineering, Texas A&M University.

Master of Engineering, Building Engineering, (May 1993)
Concordia University,
Montreal, Quebec, Canada

Bachelor of Engineering, Mechanical Engineering, (July 1988)
American University of Beirut,
Beirut, Lebanon

Awards and Professional Recognition

* **2013 ASHRAE International Student Competition.** Advised a team of students in Senior Design that submitted their entry in the ASHRAE's 2013 international student competition, in the **Integrated Sustainable Building Design** category and won the 3rd place (worldwide). It was the first time ever our students participate in this international competition, and we surely gained experience that would help our future seniors.

* **Karl O. Werwath Engineering Research Award** at Milwaukee School of Engineering (August 2012).

* **ASHRAE Distinguished Service Award (DSA)** (June 2010).

* ***2017 ASHRAE Handbook of Fundamentals* Subcommittee: Elected Member**, along with four others, to serve for four years (July 2013-June 2017) to work with Technical Committees responsible for each chapter to update and edit the handbook that is considered the "bible" of HVAC world-wide. The *Handbook* is the most visible reference material of ASHRAE. The four volumes of the *Handbook* are used throughout the world to help educate the next generation of HVAC engineers. The *Fundamentals* Volume is often the first exposure that college students have to ASHRAE, and to the HVAC fundamentals and design.

* September 2012 – May 2013, Elected **Chair of the College Faculty Appointment and Review Committee (CFARC)** (tenure committee) at **Milwaukee School of Engineering.**

* **Certificate of Appreciation** from **ASHRAE**, in recognition as a Member of the Standard Project Committee SPC120; reviewing, updating and editing the **ANSI/ASHRAE Standard 120-2008 -- Method of Testing the Determine Flow Resistance of HVAC Ducts and Fittings**.

* **Certificate of Appreciation** from **ASHRAE**, in recognition as a **Contributor** to the **2008 ASHRAE Handbook – HVAC Systems and Equipment**, June 2008.

* Invited, among around 20 professors from the U.S., by the **U.S. Department of Energy (USDOE)** to the Building Energy Simulation Summer Study in Washington D.C. (July 17-20 2007) to develop a university course using the state of the art in building energy simulation software, *EnergyPlus V.2.0*.

* **Certificate of Appreciation** from **ASHRAE**, in recognition for service as the **Chair of TC5.2** (Duct Design Technical Committee) for two years (2005-2007).

* **Building Simulation 2011. Member of the Scientific Committee,** International Building Performance Simulation Association (IBPSA) 2011 Building Simulation conference, Sydney, Australia, Nov 14-16 2011.

* **ICEBO 2006**. **Member of the Technical Committee**, International Conference for Enhanced Building Operations, Shenzhen, China, November 2006.

* Listed among **Reviewers of ASHRAE Technical and Symposium Papers**, in an appreciation article in **ASHRAE Insights**, July 2004, July 2005, July 2006.

* **Letter of Appreciation** from the **President of ASHRAE** to **MSOE** (Chair of the Civil and Architectural Engineering and Construction Management Department) for supporting my services within the technical committees TC4.7 and TC5.2, 2004

* **ASHRAE 1998-1999 Student Scholarship**, **Houston Chapter**, Houston, Texas, April 1999.

* **Trophy of the Student Project** category at the **GALA ÉNERGIA 1993** annual competition organized by the **Association Québecoise pour la Maîtrise de l'Énergie (AQME)**, **Quebec**, **Canada**, for the project "Réduction de la consommation d'électricité en utilisant des échangeurs à plaques en hiver" (*Reducing the electricity consumption by means of heat exchangers in winter*).

* **1st Prize** ($2000) awarded by the Quebec **Ministry of Energy and Resources**, for the Trophy winner of the **Student Project** category of the **CONCOURS ÉNERGIA 1993**.

Work Experience

Sep. 2009 - Present
Associate Professor, **Technical Specialty Head - Building Mechanical Systems,**
Civil and Architectural Engineering and Construction Management Department,
Milwaukee School of Engineering, Milwaukee, Wisconsin

Sep. 2002 to August 2009
Assistant Professor, **Technical Specialty Head - Building Mechanical Systems,**
Civil and Architectural Engineering and Construction Management Department,
Milwaukee School of Engineering, Milwaukee, Wisconsin

- Conducting research in the building energy performance area (please see specific research projects in the *Research and Awarded External Funding* section, below).
- Advising graduate students in the Masters of Engineering Program:
  (example of projects: Modeling the MSOE university campus buildings with DOE-2 (eQuest)).
- Teaching the following courses:
  AE-6410 Data-Driven Modeling (Grad), ME-514 Thermodynamic Applications (Grad.), AE-2121 Fundamentals of Thermodynamics, AE-213 Introduction to Fluid Mechanics, AE-2211 Building Construction Methods, AE-3112 Heat Transfer and Basic Principles of HVAC, AE-3121 Principles of Fire Suppression and Plumbing Design, AE-3131 Building Mechanical Systems I, AE-3132 Building Mechanical Systems II, AE-3301 Principles of Mechanical Systems, and EV-799 Building Energy Simulation (DOE-2, eQuest).
- Supervising the HVAC section of the Senior Design Courses: AE-4721, AE-4731, and AE-4733

Jul. 2000 to Aug. 2002
Postdoctoral Fellow Mechanical Engineer, **Lawrence Berkeley National Laboratory,**
University of California
Conducting research in the **Environmental Energy Technologies Division - Indoor Environment Department - Energy Performance of Buildings Group**. Group Leader: Dr. Max Sherman.

- Built a complete full-scale residential ducting system in the **Duct Lab**. This is a research testing facility where I conducted a performance testing of the duct installation practice in new residential construction, and existing construction renovation projects. Most commonly used duct fittings and components were tested, including flexible duct, splitter boxes, supply boots, and intake hoods. Detailed analysis of air flow and resistance performance were measured using standard ASHRAE test procedures to

determine flow restrictions and pressure losses. Whole duct system's as-installed pressure losses were also compared to calculated (predicted) pressure losses based on the tests of components. Results of this work are reported in two **ASHRAE** and **ACEEE** papers, and three **LBNL Technical Reports**. Also, used this facility to test air flow measuring instruments by TSI.

- Conducted longevity tests on commonly used UL 181B listed Duct Tape, according to the manufacturers configurations, where the duct tape is sealing flexible duct to sheet metal duct, and sustaining air temperatures of 212°F. Results are reported in an **LBNL Technical Report**, and an ICEBO paper.

- Performed an analysis on the impact of air duct sealing on energy use and electricity demand of small commercial buildings, involving the characterization of small commercial buildings and their HVAC systems, pre/post-duct-sealing monitoring of electricity demand and analysis of savings. Results are reported in an **LBNL Technical Report**.

- Participated in *Residential and Commercial Buildings Commissioning and Energy Analysis* projects:
  - a CEC (California Energy Commission) sponsored project, through the Public Interest Energy Research Program (PIER): *Instrumented Home Energy Rating and Commissioning*. Helped in conducting the residential commissioning work on 5 houses in California (field assessment of residential commissioning tools and procedures), and developed a model (with CONTAM96) for a typical house, in order to validate a duct leakage measurement method (DeltaQ) developed at LBNL.
  - a DOE funded project: *Commercial Thermal Distribution System*. Helped in the field study of the duct sealing of a VAV system using the LBNL developed, AEROSEAL, procedures, in a commercial office building in Napa, California.
  - a CEC sponsored project: Helped in the installation of data loggers and sensors (power, air flow, pressure drop, temperature and relative humidity) on a VAV air distribution system on two floors (32,000ft^2 each) of the CAL-EPA building in Sacramento, CA. The project's objective is to demonstrate the savings potentials of sealing the ducting system in a large commercial building.

Feb. 1999 to Jul. 2000 — **Research Assistant**, **Energy Systems Laboratory**, **Texas A&M University**
In charge of an ASHRAE Research Project, 1093-RP, *Compilation of Diversity Factors and Schedules for Energy and Cooling Load Calculations*. Principal Investigators: Drs. Jeff Haberl and David Claridge.

May 1998 to Jan. 1999 — **Research Assistant**, **Energy Systems Laboratory**, **Building Energy Analysis Group**, **Texas A&M University**
Baselining, modeling, savings calculations, and energy analysis for different buildings under the *Texas LOANSTAR Program* and other projects; analysis covering monitored energy use in University Campuses, Schools, Hospitals, Governmental Complexes, and Office Buildings.
Projects fully in charge: The *City of Austin buildings* (over 40 buildings), *Prairie-View University Campus* (over 40 buildings), *GERG Bldg. - TAMU* (a laboratory with high heat and moisture generation, and fume hoods; energy analysis, recommendations, and design of an alternative HVAC system to solve a high humidity problem).

Sep. 1997 to May 1998 — **Teaching Assistant**, **Department of Mechanical Engineering**, **Texas A&M University**
for the ENGR 212, **Engineering Principles II**, course. Assisting the professor in teaching 90 students the principles of Thermodynamics, Heat Transfer and Fluid Mechanics (2 semesters).

Jan. 1997 to Aug. 1997 — **Research Assistant**, **Energy Systems Laboratory**, **Building Energy Analysis Group**, **Texas A&M University**
Developing baseline and post-retrofit models of the total electricity, chilled water and hot water consumption of buildings monitored under the *Texas LOANSTAR Program*, to calculate monthly energy savings.
Participating in the ASHRAE Research Project 1004, *Methodology Development to Determine the Long Term Performance of Cool Storage Systems from Short Term Measurements.*

Sep. 1996 to Dec. 1996 — **Part-time Instructor**, **Centre for Building Studies**, **Concordia University**
Teaching **Engineering Drawing** to a class of 70 students, both manually and with AUTOCAD.

Sep. 1994 to Aug. 1996 — **Teaching Assistant, Centre for Building Studies**, **Concordia University**
Assisting the professor in teaching the **Thermodynamics** and **Engineering Drawing** courses.

Apr. 1993 to — **Research Assistant, Centre for Building Studies**, **Concordia University**
Developing DOE-2 simulations of institutional and commercial buildings; data visualization, and evaluation of

Apr. 1994 energy conservation measures.

Summer 1992 **Mechanical Engineer**, Contract with **Bell Canada**, Montreal, Quebec, Canada
Detailed study of the Cooling Tower "Free Cooling" systems used within the Chilled Water Systems, and a feasibility study of the installation of a Water-Side Economizer in the Bell-Banque Complex building in Montreal.

Nov. 1988 to Aug. 1990 **Mechanical Engineer**, **KHATIB & ALAMI, Consolidated Engineering Company**[1], Beirut, Lebanon (http://www.khatibalami.com/)
Co-ordination and participation within a team of mechanical, electrical, and civil engineers, and architects for specified projects. Design and analysis of cooling, refrigeration, heating, ventilation, HVAC equipment selection, water supply, drainage, fire and smoke control, piping, ducting, and water treatment projects.

Research and Awarded External Funding

* **Principal Investigator**, "*Developing a Model of an NZE (Net Zero Energy) Campus in a DERS Environment",* a one-year (April 2014-March 2015) $75,000 research project funded by the Mid-West Energy Research Consortium (m-WERC) that will provide an NZE proof-of-concept for institutional and commercial buildings (campuses) in a micro-grid environment that can reduce energy costs, carbon emissions and dependence on fossil fuel.

* **Principal Investigator**, "*Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance*", a 2.5 year (Sep 2009 – Feb 2012) $200,000 ASHRAE research project (RP-1404), to develop a new methodology in building energy modeling that will be used in: (1) detailed audit for investment grade energy conservation measures (ECM); (2) savings calculation from already installed ECMs and verification against pre-retrofit claims using pre/post monitored data of pre-stipulated length; and (3) ascertaining claims made by newly constructed "green" or high performance building owners or designers by actual monitoring as required for performance based certification. I supervised a graduate student, Mitchell Paulus, who worked as a Research Assistant on this project (used it as his capstone-project for his Masters of Science in Engineering, and graduated in February 2012).

* **Co-Principal Investigator**, "*Developing a Business Case for Sustainable Asset Renewal of Existing Buildings*", an $85,000 pilot project funded by the USDOE's National Energy Technology Laboratory (NETL), through the Southeastern Wisconsin Energy Technology Research Center (SWETRC), to implement an advanced monitoring system, develop building energy performance models, and use Building Information Modeling (BIM) techniques in the Milwaukee County Research Park's (MCRP) Technology Innovation Center (TIC) building. The overall objective of the project is to reduce energy consumption in existing buildings and to widen the expertise of participating professionals resulting in fostering regional technology transfer, and to apply the best practices learned to sustainable restorations of historically significant buildings, July 2009-June 2010.

* **Co-Principal Investigator**, "*Renewable Energy Demonstration Project on the MSOE Campus*". A $133,000 project involving a 29-kilowatt solar photovoltaic (PV) array installed on the roof of the Student Life and Campus Center building (1025 N. Broadway) to generate electric power from incident solar radiation. This project provides clean, renewable energy to the utility grid, increases awareness of renewable energy technologies, and serves as a laboratory for students in Architectural, Mechanical, and Electrical Engineering at MSOE. The application helps students better understand a PV system including its engineering requirements, system performance, system maintenance and life-cycle costs. The project was funded by *We Energies* (The utility company in south-eastern Wisconsin) ($35,000), and the State of Wisconsin's *Focus on Energy* program ($98,000), November 2006.

* **Principal Investigator**, "*Energy Performance Analysis of the MSOE campus*". This project was awarded $16,000 worth of energy monitoring equipment (power transducers, sensors and data loggers) from **Johnson Controls**, to fully monitor the whole building electricity consumption of a dormitory building and its HVAC system. The data can be viewed and analyzed in the classroom via an Ethernet network. We tested the latest version of a monitoring software developed by Johnson Controls on one of our buildings, designated as a test-site. The data analysis and the simulations allow to: (1) allocate the loads for individual buildings as utility meters are shared by more than one building on campus, (2) diagnose their performance, and (3) recommend appropriate energy conservation measures and their economic and environmental impact, December 2004.

* **Consultant and Advisor, Texas A&M University - Energy Systems Laboratory** ($15,000), conducting pressure loss measurements on flexible ducts and fittings at the Texas A&M Air Distribution Systems laboratory facility. The project was funded by the Air Diffusion Institute (ADI) and ASHRAE (research project URP 1333). The project started in August 2005. I spent two summers in Texas (2005 and 2006) while

[1] Ranked 84th among the Top 200 International Engineering firms during my tenure, (ENR magazine, July 1992).

communicating by email throughout the project work. I advised two Mechanical Engineering Masters students who conducted the tests. I participated in reviewing and editing their technical reports and published papers summarizing the results.

* Member of the **Project Monitoring Subcommittee (PMSC)** of the project "CFD Shootout Contest – Prediction of Duct Fitting Losses (1493-RP)", sponsored by the ASHRAE Technical Committee 5.2 (Duct Design), June 2010 - ongoing.

* Member of the **Project Monitoring Subcommittee (PMSC)** of the project "Procedures for Reconciling Computer-Calculated Results with Measured Energy Data (1051-RP), sponsored by the **Data-Driven Modeling** Subcommittee of the ASHRAE Technical Committee 4.7 (Energy Calculations), June 2003 – 2005.

***** Built a new **Residential Duct Lab** facility at Lawrence Berkeley National Laboratory (Energy Performance of Building Group), consisting of a complete full-scale residential ducting system (1200 cfm), that is fully monitored in terms of flow, and pressure drop. This is a research testing facility to conduct a performance testing of the duct installation practice in new residential construction, and existing construction renovation projects, 2001.

***** Built and operated an oven that provides a constant and uniform 100 C temperature for the "baking" tests of Duct Tape, according to the "Temperature Test of Pressure-Sensitive Tape" requirements in the UL 181B Standard, Lawrence Berkeley National Laboratory, 2002.

***** **Co-Author, Research Bid Proposal for ASHRAE 1093-TRP**, and **Research Assistant**, "Compilation of Diversity Factors and Schedules for Energy and Cooling Load Calculations", which was awarded the contract ($65,397), Texas A&M University, May 1998.

***** **Research Assistant, ASHRAE 1004-RP,** "Methodology Development to Determine the Long Term Performance of Cool Storage Systems from Short Term Measurements"; a $86,963 Research Grant, Texas Engineering Experiment Station, Texas A&M University, May 1997.

Publications

Book Chapters:

***** **2008 ASHRAE Handbook of HVAC Systems and Equipment, Chapter 18, Duct Construction.** Editing the whole chapter, as a member of a subcommittee appointed by the ASHRAE TC5.2 Duct Design technical committee.

***** **2005 ASHRAE Handbook of Fundamentals, Chapter 34, Duct Design.** Updating the flexible ducts section based on my research results and editing the whole chapter, as a member of a subcommittee appointed by the ASHRAE TC5.2 Duct Design technical committee.

Standards:

* **ANSI/ASHRAE Standard 120-2008 -- Method of Testing the Determine Flow Resistance of HVAC Ducts and Fittings.** Editing the whole standard and updating the flexible ducts section based on my research, as a member of a subcommittee appointed by the ASHRAE TC5.2 Duct Design technical committee.

Refereed Journals:

* Abushakra, B., and Paulus M. 2015-a. "An Hourly Hybrid Multivariate Change-point Inverse Model Using Short-term Monitored Data for Annual Prediction of Building Energy Performance, Part I: Background (RP-1404)". In preparation for submittal to the ***Science and Technology for the Built Environment, ASHRAE. Taylor & Francis***.

* Abushakra, B., and Paulus M. 2015-b. "A Hourly Hybrid Multivariate Change-point Inverse Model Using Short-term Monitored Data for Annual Prediction of Building Energy Performance, Part II: Methodology (RP-1404)". In preparation for submittal to the ***Science and Technology for the Built Environment, ASHRAE. Taylor & Francis***.

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* Abushakra, B., and Paulus M. 2015-c. "A Hourly Hybrid Multivariate Change-point Inverse Model Using Short-term Monitored Data for Annual Prediction of Building Energy Performance, Part III: Results and Analysis

(RP-1404)". In preparation for submittal to the ***Science and Technology for the Built Environment, ASHRAE. Taylor & Francis***.

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* Singh, V., Reddy, T.A., and Abushakra, B. 2014. "Predicting Annual Energy Use in Buildings Using Short-Term Monitoring: The Dry Bulb Temperature Analysis (DBTA) Method (RP-1404)". ***2014 ASHRAE Transactions***, Vol. 120.

* Singh, V., Reddy, T.A., and Abushakra, B. 2013. "Predicting Annual energy Use in Buildings Using Short-term Monitoring: The Daily Hybrid Multivariate Change-point Inverse Model (RP-1404)". ***2013 ASHRAE Transactions***, Vol. 119.

* Abushakra, B., Claridge, D.E. 2008. "Modeling Office Building Occupancy in Hourly Data-Driven and Detailed Energy Simulation Programs". ***ASHRAE Transactions***, Vol.114, Part 2.

* Abushakra, B., Walker, I.S., and Sherman, M.H. 2004. "Compression Effects on Pressure Loss in Flexible HVAC Ducts". ***International Journal of HVAC&R Research***, **ASHRAE**, Volume. 10, Number 3, pp. 275-289, July 2004, ASHRAE.

* Abushakra, B., Haberl, J.S., and Claridge, D.E. 2004. "Overview of Literature on Diversity Factors and Schedules for Energy and Cooling Load Calculations". ***ASHRAE Transactions***, Vol.110, Part 1, pp. 164-176.

* Claridge, D.E., Abushakra, B., Haberl, J.S., and Streshthaputra A. 2004. "Electricity Diversity Profiles for Energy Simulation of Office Buildings". ***ASHRAE Transactions***, Vol. 110, Part 1, pp. 365-377.

* Zmeureanu, R., Abushakra, B., and Fazio, P. 1995. "A Case Study of Energy Savings by Using the Water-side Economizer System in a Large Office Building in Montreal", ***Architectural Science Review***, **Vol.38**, **Num.1**, **March**, University of Sydney, Australia.

Peer-Reviewed Conference Proceedings:

* Abushakra, B., Shiltz, d., Woo, J., Nasiri, A., and Damm, C. 2015. "Baselining the Energy Consumption of an Existing College Campus in a Feasibility Study of Achieving a Net-Zero Energy (NZE) Goal". **2015 AEI Conference Proceedings**, ASCE, Milwaukee, WI.

* Abushakra, B. 2005. "Load Allocation through Detailed Simulation Calibrated with Monitored Data". ***International Conference for Enhanced Building Operations (ICEBO)***, Pittsburgh, Pennsylvania, October 11 13.

* Abushakra, B. 2003. "Longevity of Duct Tape in Residential Air Distribution Systems". ***International Conference for Enhanced Building Operations (ICEBO)***, Berkeley, California, October 13-15.

* Abushakra, B., Walker, I.S. and Sherman, M.H. 2002. "A Study of Pressure Losses in Residential Air Distribution Systems". Proceedings of the ***2002 ACEEE Summer Study on Energy Efficiency in Buildings***, Pacific Grove, California, August 18-23, 2002.

* Abushakra, B., and Claridge, D.E. 2001. "Accounting for the Occupancy Variable in Inverse Building Energy Baselining Models". ***International Conference for Enhanced Building Operations (ICEBO)***, Austin,Texas, July 16-19.

* Abushakra, B., and Claridge, D.E. 2000. "Effect of Dry-Bulb Temperature on the Prediction Bias of Building Energy Use with the Short-term Monitoring Long-term Prediction Method". **Proceedings of *the ASME International Solar Energy Conference***, ***Solar 2000***, Madison, Wisconsin, June 17-22.

* Abushakra, B., Claridge, D.E., and Reddy, T.A. 1999. "Investigation on the Use of Short-term Monitored Data for Long-term Prediction of Building Energy Use". **Proceedings of the *International Joint Conference of ASME/KSME/JSME/ASHRAE/SAREK/JSES/KSES, Renewable and Advanced Energy Systems for the 21st Century***, Lahaina, Maui, Hawaii, April 11-15.

* Del Campo, C., Abushakra, B., Asselta, C., Annamalai, K., and Lalk, T. 1998. "Comparison Between Theoretical and Actual Performance of a Polymer Electrolyte Fuel Cell Using Availability Analysis", **Proceedings of the *ASME 20th Annual ETCE - Energy Sources Technology Conference,* ASME - Petroleum Division**, Houston, Texas, February.

* Abushakra, B. 1997. "An Inverse Model to Predict and Evaluate the Energy Performance of Large Commercial and Institutional Buildings", **Proceedings of the *International Building Performance Simulation Association* (*IBPSA) - Building Simulation '97 Conference***, Prague, Czech Republic, September 8-10.

* Abushakra, B., Zmeureanu, R., and Fazio, P. 1995. "Evaluation of Conventional Inverse Models for Predicting Electricity Demand of a Large Institutional Building", **Proceedings of the *Second International Conference on Indoor Air Quality and Energy Conservation in Buildings***, Montreal, Canada, May 9-12.

Technical Reports:

* Abushakra B., Paulus M., Reddy T.A. and Singh V. 2014, Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance, ASHRAE RP-1404 Final Report. American Society of Heating, Refrigerating and Air-conditioning Engineers. Atlanta, GA.

* Abushakra, B. 2002. "Longevity of Duct Tape in Residential Air Distribution Systems: 1-D, 2-D, and 3-D Joints". **LBNL Technical Report, LBNL-51099**, Lawrence Berkeley National Laboratory.

* Sherman, M., Xu, T., Abushakra, B., Dickerhoff, D., Wray, C., Wang, D., and Modera, M. 2002. "Thermal Distribution System Characteristics and Energy Impacts of Duct Leaks in Light Commercial Buildings". **LBNL Technical Report, LBNL-49470**, Lawrence Berkeley National Laboratory.

* Abushakra, B., Walker, I.S., and Sherman, M.H. 2002. "A Study of Pressure Losses in Residential Air Distribution Systems". **LBNL Technical Report, LBNL-49700**, Lawrence Berkeley National Laboratory.

* Abushakra, B., Walker, I.S., Dickerhoff, D.J., and Sherman, M.H. 2002. "Laboratory Study of Pressure Losses in Residential Air Distribution Systems". **LBNL Technical Report, LBNL-49293**, Lawrence Berkeley National Laboratory.

* Abushakra, B., Walker, I.S., and Sherman, M.H. 2002. "Compression Effects on Pressure Losses in Flexible HVAC Ducts". **LBNL Technical Report, LBNL-49012**, Lawrence Berkeley National Laboratory.

* Abushakra, B., Streshthaputra, A., Haberl, J.S., and Claridge, D.E. 2000. "Compilation of Diversity Factors and Schedules for Energy and Cooling Load Calculations – Final Report". **ASHRAE RP-1093 Final Report**. American Society of Heating, Refrigerating and Air-conditioning Engineers. Atlanta, GA, and **Energy Systems Laboratory Technical Report**, **ESL-TR-00/09-01**, Department of Mechanical Engineering, Texas A&M University, September.

* Abushakra, B., Haberl, J.S., and Claridge, D.E., Streshthaputra, A. 2000. "Compilation of Diversity Factors and Schedules for Energy and Cooling Load Calculations - Compilation of Diversity Factors and Load Shapes". **Energy Systems Laboratory Technical Report**, **ESL-TR-00/06-01**, Department of Mechanical Engineering, Texas A&M University, June.

* Sreshthaputra, A., Abushakra B., Haberl, J.S., and Claridge, D.E. 2000. "Data Visualization for Quality-Check Purposes of Monitored Electricity Consumption in All Office Buildings in the ESL Database". **Energy Systems Laboratory Technical Report**, **ESL-TR-00/03-01**, Department of Mechanical Engineering, Texas A&M University, March.

* Zhu, Y., Claridge, D.E., Giebler, T., Abushakra, B., and Turner, W.D. 1999. "Report of Energy Efficiency Study and Metering/Utility Profile for Electricity Deregulation at the Prairie View A&M University (PVAMU), Prairie View, Texas". **Energy Systems Laboratory Technical Report**, **ESL-TR-99/12-10**, Department of Mechanical Engineering, Texas A&M University, December.

* Abushakra, B., Haberl, J.S., and Claridge, D.E. 1999. "Compilation of Diversity Factors and Schedules for Energy and Cooling Load Calculations - Identified Relevant Data Sets, Methods and Variability Analysis". **Energy Systems Laboratory Technical Report**, **ESL-TR-99/12-01**, Department of Mechanical Engineering, Texas A&M University, December.

* Abushakra, B., Haberl, J.S., and Claridge, D.E. 1999. "Compilation of Diversity Factors and Schedules for Energy and Cooling Load Calculations - Literature Review and Database Search". **Energy Systems Laboratory Technical Report**, **ESL-TR-99/05-01**, Department of Mechanical Engineering, Texas A&M University, May.

* Abushakra, B., Claridge, D.E., Haberl, J.S., Eggebrecht, J., and Carlson, K. 1998. "Energy Analysis, Baselining and Modeling of Prairie View A&M University Campus". **Energy Systems Laboratory Technical Report**, **ESL-TR-98/12-01**, Department of Mechanical Engineering, Texas A&M University, December.

* Abushakra, B. 1996. "A New Methodology to Predict and Evaluate the Energy Performance of Large Commercial and Institutional Buildings for Pre- and Post-Retrofit Periods: The Inverse Model". **Technical Report**. Centre for Building Studies, Concordia University, Montreal, Canada.

* Abushakra, B. 1995. "Option Offered by Inverse Models in Estimating the Energy Performance of Large Existing Buildings Using Short-term and Long-term Measurements". **Technical Report**. Centre for Building Studies, Concordia University, Montreal, Canada.

* Abushakra, B. 1993. "Presenting the Enormous Amount of Data Produced by the DOE-2 Simulations through Compact 2-D and 3-D Profiles". **Technical Report**. Centre for Building Studies, Concordia University, Montreal, Canada.

* Abushakra, B 1992. "Chilled Water System Performance and Free Cooling Mode; Implementation of a Plate Heat Exchanger (A Case Study on "Complexe Bell-Banque" Towers, Montreal, Quebec)". **Technical Report**. Centre for Building Studies, Concordia University, Montreal, Canada.

Seminars

* ***ASHRAE Illinois Research Night***, Lombard, IL, February 10 2015, Invited Speaker. "Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance, ASHRAE RP-1404".

* ***M-WERC Technology Innovation Symposium***, Milwaukee, Wisconsin, November 2014. "Developing a Model of an NZE (Net Zero Energy) Campus in a DERS Environment". Symposium held at University of Wisconsin - Milwaukee.

* ***ASHRAE Annual Meeting***, Montreal, Canada, June 2011. "Initial Findings in RP-1404 - Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance", part of Seminar *49 "Building Simulation 103: Inverse Modeling Tools"*.

* ***ASHRAE Annual Meeting***, Poster Session, Salt Lake City, UT, June 2008. "Modeling Office Building Occupancy in Hourly Data-Driven and Detailed Energy Simulation Programs".

* ***ASHRAE Winter Meeting,*** *Chicago, January 21-25, 2006.* "Load Allocation through Detailed Simulation Calibrated with Monitored Data", part of *Seminar 41 "How and Why to Calibrate a Simulation to Measured Data".*

* ***ASHRAE Annual Meeting***, Poster Session, Long Beach, CA, January 2004, "Overview of Literature on Diversity Factors and Schedules for Energy and Cooling Load Calculations".

* Environmental Energy Technologies Division Seminar, Berkeley Lab, Berkeley, CA, July 2002, "Longevity of Duct Tape in Residential Air Distribution Systems: 1-D, 2-D, and 3-D Joints".

* Environmental Energy Technologies Division Seminar, Berkeley Lab, Berkeley, CA, March 2002, "A Laboratory Study of Pressure Losses in residential Air Distribution Systems".

* Building Energy Seminar (BES), Berkeley Lab, Berkeley, CA, September 2000, "Short-term Monitoring Long-term Prediction of Energy Use in Commercial and Institutional Buildings: the SMLP Method".

* Invited Doctoral Seminar at the Center for Building Performance and Diagnostics, Department of Architecture, Carnegie Mellon University, Pittsburgh, PA, July 1999, "Short-term Monitoring Long-term Prediction of Energy Use in Large Commercial and Institutional Buildings - the SMLP Method".

* Invited Seminar at Carnegie Mellon University, Pittsburgh, Pennsylvania, July 1999, "An Overview of the Energy Systems Laboratory and the Work Done in Monitoring and Commissioning".

* Invited Doctoral Seminar at Alfred University, Division of Mechanical Engineering, Alfred, New York, July 1999, "Short-term Monitoring Long-term Prediction of Energy Use in Large Commercial and Institutional Buildings - the SMLP Method ".

* Monthly Seminar of the ASHRAE Student Chapter, Texas A&M University, College Station, Texas, February 1999, "Energy Analysis, Baselining, and Modeling of Prairie View A&M University Campus".

* Doctoral seminar at the Centre for Building Studies, Concordia University, Montreal, Canada, March 1996, "A new methodology to predict and evaluate the energy performance of large commercial and institutional buildings: The Inverse Model".

* Doctoral seminar at the Centre for Building Studies, Concordia University, Montreal, Canada, February 1995, "Using Inverse Models in predicting the energy performance of large commercial and institutional buildings".

Professional Memberships and Activities

* Member of **ASEE (American Society of Engineering Education)**, #52154.

* Member of **ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers),** # 05070209.
  - ***2017 ASHRAE Handbook of Fundamentals* Subcommittee: Elected Member**, along with four others, to serve July 2013-June 2017 to edit, and work with Technical Committees responsible for each chapter, to update the handbook considered the "bible" of HVAC fundamentals world-wide.
  - **Multidisciplinary Task Group – Energy-efficient Air-handling Systems for non-residential buildings (MTG-EAS): Alternate Member.**
  - **TC4.7 Energy Calculations: Vice-Chair, Voting Member;** (July 2014 – Present)
  - **TC4.7 Energy Calculations: Secretary, Voting Member;** (July 2012 – 2014).
  - **TC4.7 Energy Calculations: Voting Member; Chair of the Data-Driven Modeling Subcommittee, Chair of the Research Subcommittee** (July 2010 – June 2012). **Voting Member** rolling on and off since 2003.
  - **TC5.2 Duct Design: Chair of the Committee (**July 2005 – July 2007), **Voting Member** rolling on and off since 2003.
  - **TC7.6 Building Energy Performance: Corresponding Member** since 2003.
  - **MSOE Student Branch Advisor** since 2002.

* Member of the California utility company PG&E's Technical Advisory Group (TAG) on the *Energy Management and Information Systems (EMIS) Baseline Modeling Performance Criteria and Testing Protocol for Whole Building Energy Program Applications* (I was invited to serve in October 2012, and accepted the invitation).

* Member of the **International Building Performance Simulation Association (IBPSA)**.

* Junior Member (Member in Training) of the **Quebec Board of Engineers**, Quebec, Canada (Ordre des Ingenieurs du Quebec), # 107360, prior to coming to the USA in January 1997 for my Ph.D. studies.

* Member of the **Association Québecoise pour la Maîtrise de l'Énergie (AQME),** # 1667.

* Reviewed the **ASHRAE Standard 120** (*Method of Testing to Determine Flow Resistance of HVAC Ducts and Fittings*) as a **member of the Standard Project Committee (SPC120), 2006-2007**.

* Regular Reviewer of proposals for the **California Energy Commission (CEC)**, in their *Building Energy Research Grant Program (BERG)*, and *Energy Innovations Small Grant Program (EISG)*, related to building energy efficiency technologies.

* Member of the **Scientific Committee** and **Paper Reviewer** for the International Building Performance Simulation Association (IBPSA) **Building Simulation 2011 Conference**, Sydney, Australia, Nov 14-16 2011.

* Reviewer for the widely used McGraw-Hill Fluid Mechanic textbook by Yunus Cengel and John Cimbala, *Fluid Mechanics Fundamentals and Applications*, 3rd edition, McGraw Hill 2013 (reviewed 3 chapters).

* Reviewer for papers in academic and professional conference proceedings including:

  - ***ASHRAE Transactions papers:*** Regularly review papers for ASHRAE related to modeling of building energy use, and air distribution systems design.
  - ***ASCE (American Society of Civil Engineers) papers:*** Reviewed papers related to thermal modelling and characteristics of buildings for ASCE, for possible publications in their journals.
  - ***International Conference for Enhanced Building Operations (ICEBO)***, 2001, 2003, and 2005.
  - ***ACEEE Summer Study on Energy Efficiency in Buildings***, Pacific Grove, California, August 18-23, 2002.

- **Proceedings of *the ASME International Solar Energy Conference*, *Solar 2000***, Madison, Wisconsin, June 17-22, 2000.
- ***International Joint Conference of ASME/KSME/JSME/ASHRAE/SAREK/JSES/KSES, Renewable and Advanced Energy Systems for the 21st Century***, Lahaina, Maui, Hawaii, April 11-15 1999.

Academic Activities

* September 2014 – Present, **Member of the Faculty Development Committee** at **Milwaukee School of Engineering.**

* September 2012 – May 2013, **Chair of the College Faculty Appointment and Review Committee (CFARC)** (tenure committee) at **Milwaukee School of Engineering.**

* September 2012 – May 2013, **Member of the Graduate Programs Council (GPC)** at **Milwaukee School of Engineering.**

* September 2012 – Present, **Member of the Faculty Senate** at **Milwaukee School of Engineering**.

* September 2011 – May 2012, **Member of the College Faculty Appointment and Review Committee (CFARC)** at **Milwaukee School of Engineering**.

* September 2009 – Present, **Member of the Athletic Eligibility Appeals Committee** at **Milwaukee School of Engineering**.

* September 2007 – May 2013, **Mentor, MSOE Mentors Program** (faculty helping Freshmen students adapting to the new college environment), at **Milwaukee School of Engineering**.

* August 2008 – May 2009, **Vice Chair of the Faculty Senate** at **Milwaukee School of Engineering**.

* August 2008 – May 2009, **Member of the Executive Educational Council** at **Milwaukee School of Engineering**.

* August 2008 – May 2009, **Member of the Security Committee** at **Milwaukee School of Engineering**.

* August 2007 – May 2008, **Faculty Council President**, and **Faculty Senate Chair** at **Milwaukee School of Engineering**.

* September 2004 – May 2009, **Member** in the **Faculty Senate** at **Milwaukee School of Engineering**, representing the Civil and Architectural Engineering and Construction Management Department.

* September 2003 - June 2004, **Member** of the interdepartmental **Computer Users Committee** at Milwaukee School of Engineering.

* September 2002 - Present, **Building Mechanical Systems – Technical Specialty Head, Civil and Architectural Engineering and Construction Management Department, Milwaukee School of Engineering**.

* September 2002 - Present, **ASHRAE Student Branch Advisor – Milwaukee School of Engineering**.

* 1998 - 1999, **Vice President** of the **ASHRAE Student Chapter - Texas A&M University**.

* March 1996, **Judge** in the science competition "**BELL MONTREAL REGIONAL SCIENCE FAIR (BMRSF '96)**", organized at Loyola High School, Montreal (QC), for the finalists of the Colleges and High Schools of Montreal and Laval, Quebec, Canada.

* 1996 - 1997, **President** of the "**Engineering and Computer Science Graduate Association (ECSGA)**", **Concordia University**.

* 1995 - 1996, **Centre for Building Studies Graduate Students Representative** in the "**Engineering and Computer Science Graduate Association (ECSGA)**", **Concordia University.**

* 1995 - 1996, **Member of the *Curriculum Committee***, **the *Teaching Committee***, and **Observer in the *Faculty Meetings*** of the **Centre for Building Studies, Concordia University**.

* 1996, **Member (Graduate Students Representative)** in the **Search Committee for the New Dean** of the **Faculty of Engineering and Computer Science**, **Concordia University**.

Graduate Courses Taken in the Masters in Ph.D. Degrees

Concordia University
Building Engineering Systems, Building Science, Building Environment, Building Enclosure, Building Illumination, Integrated Building Design, Indoor Air Quality, Design of Heating Air Conditioning and Ventilation Systems, Thermal Performance of Building Envelope, Automatic Control of Building Environmental Systems, Building Economics, and Legal Issues in Construction.

Texas A&M University
Advanced Engineering Thermodynamics, Intermediate Heat Transfer, Fluid Mechanics, Aerothermodynamics of Turbomachinery, Cogeneration Systems, Energy Management in Commercial Buildings, Application of Energy Management, and Statistical Analysis.

Hobbies Photography, Travel, Hiking, Biking, Jogging, Soccer, Badminton, Racquetball, Car Shows and Magazines, and Cinema.