

# CONTENTS

Host Chapter .....	xiii
Program Committee and Transactions Staff .....	xiii
Welcoming Remarks by James E. Wolf, 2000-2001 ASHRAE President.....	xiv
Technical Program Abstracts .....	xvii

## TECHNICAL PAPERS

4410 ( <i>International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research</i> ) Dynamic Modeling of Encapsulated Ice Tank for HVAC System Simulation Yingxin Zhu and Yan Zhang .....	3
4411 Modeling and Analysis of Gas Coolers Xiang D. Fang, Clark W. Bullard, and Predrag S. Hrnjak .....	4
4412 Multiple Model Approach of a Residential Heat Pump for Integration in a Building Thermal Simulation Code Comparison with Experimental Results Francois Garde, Frank Lucas, Harry Boyer, and Jean Brau .....	14
4413 Optimal Sizing of Hybrid Ground-Source Heat Pump Systems That Use a Cooling Pond as a Supplemental Heat Rejecter—A System Simulation Approach Mahadevan Ramamoorthy, Hui Jin, Andrew D. Chaisson, and Jeffrey D. Spitler.....	26
4414 (RP-991) Simulation of Source Energy Utilization and Emissions for HVAC Systems Robert A. Gansler, Douglas T. Reindl, and Todd B. Jekel .....	39
4415 Assessment of Thermal Comfort During Surgical Operations Rodrigo Mora, Michael J.M. English, and Andreas K. Athienitis .....	52
4416 ( <i>International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research</i> ) Predicting the Frequency and Costs of Hot and Cold Complaints in Buildings Clifford C. Federspiel.....	63
4417 Temperature Efficiency of Rooms with Displacement Ventilation Hong-Zuo Zhao and Lei Zhao .....	64
4418 Prediction of Skin and Clothing Temperatures Under Thermal Transient Considering Moisture Accumulation in Clothing Tetsuya Umeno, Shuichi Hokoi, and Saturo Takada.....	71
4419 Vote Method of Deciding Supply Air Temperature Setpoint for VAV Air-Conditioning System Xiangyang Chen and Kazuyuki Kamimura .....	82
4420 (RP-1054) A Descriptive Framework for Cool Storage Operating and Control Strategies Chad B. Dorgan, Charles E. Dorgan, and Ian B.D. McIntosh.....	93
4421 A New Technique to Improve the Efficiency of Wet Cooling Tower Suibing Lui and Qi Zhou .....	102
4422 ( <i>International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research</i> ) A Numerical Investigation for the Heat and Mass Transfer Between Parallel Flow of Air and Desiccant Falling Film in a Fin-Tube Arrangement Ahmad S. Rahmah, Moustafa M. Elsayed, and Najem M. Al-Najem .....	108

4423	A Simple Approach to Thermal Performance Analysis of Small Hermetic Reciprocating Compressors Man-Hoe Kim and Clark W. Bullard .....	109
4424	A Simplified Tool for Assessing the Feasibility of Ground-Source Heat Pump Projects Michel Parent .....	120
4425	Flow Calculations for Fixed-Area Expansion Devices Xiande Fang.....	130
4426	<i>(International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research)</i> Calibration of a Calorimeter for Thermal Resistance Measurements of Advanced Insulation Panels M.W. Ellis, A.H. Fanney, and M.W. Davis.....	140
4427	Chloride, Fluoride, and Acidity Measurements in Refrigerants Ngoc Dung T. Rohatgi, Tonya T. Whitmire, and Robert W. Clark .....	141
4428	Dedicated Outdoor Air-Dual Wheel System Control Requirements Stanley A. Mumma.....	147
4429	(RP-909) Determine the Efficacy of Antimicrobial Treatments of Fibrous Air Filters Karin K. Foarde and James T. Hanley .....	156
4430	The Potential Application of Water Mist System for Fire Protection in Atria W.K. Chow and B. Yao .....	171
4431	Effect of 1997 Handbook Summer Design Temperature Specifications on Enthalpy and Humidity Ratio James W. Stevens .....	178
4432	Efficacy of DBNPA Against <i>Legionella pneumophila</i> : Experimental Results in a Model Water System Yang Gao, Ping Zhou, Y. Eason Lin, Radisav D. Vidic, and Janet E. Stout .....	184
4433	Energy Retrofit of a Neoclassic Office Building—Social Aspects and Lessons Learned Constantinos A. Balaras .....	191
4434	(RP-880) Evaluation of Biofiltration of Air—An Innovative Air Pollution Control Technology Kevin A. Janni, Walter J. Maier, Thomas H. Kuehn, Ching-Hsu Yang, Barry B. Bridges, Donald Vesley, and Melissa A. Nellis .....	198
4435	(RP-986) Experimental Determination of the Effects of Turbulence Intensity on the Performance of Rotating Vane Anemometers Dawn M. Morris, B. Terry Beck, and Mohammad H. Hosni .....	215
4436	Experimental Study of an R-407C Heat Pump Water Heater Vince C. Mei, Ronald E. Domitrovic, Wayne H. Brewer, Fang C. Chen, and Titu R. Doctor .....	224
4437	Experimental Study of Flow Characteristics of a Diffuser for Under Floor Air-Conditioning System Youngil Kim, Kiseob Lee, and Hyunghee Cho .....	230
4438	(RP-813) Forced Dispersion of Ammonia Plumes into the Atmosphere Donald L. Fenton, Clayton D. Walenta, and Kirby S. Chapman .....	237
4439	Heat and Mass Transfer Properties of Zeolite 13X-H <sub>2</sub> O Adsorption Reactor Manxi Hou and Yiming Yang .....	248

4440	Heat Transfer and Pressure Drop of Gas Coolers Xiande D. Fang, Clark W. Bullard, and Predrag S. Hrnjak .....	255
4441	<i>(International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research)</i> Intelligent Control to Reduce Superheat Hunting and Optimize Evaporator Performance in Container Refrigeration P.G. Jolly, C.P. Tso, P.K. Chia, and Y.W. Wong.....	267
4442	<i>(International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research)</i> Long-Term Hydraulic Performance of Dehumidifying Heat Exchangers With and Without Hydrophilic Coating Jingchun Min, Ralph L. Webb, and Charles H. Bemisderfer .....	268
4443	<i>(International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research)</i> Nucleate Boiling of Halocarbon Refrigerants: Heat Transfer Correlations Gherhardt Ribatski and José M. Salz Jabardo .....	269
4444	Optimization of Hydraulic Conditions in District Heating Networks Xuzhong Qin, Yi Jiang, and Yingxin Zhu .....	270
4445	Spatial Homogeneity of Air in a Mushroom Tunnel: Single vs. Boost Duct Air Distribution Systems David P. Martin, John V. Ringwood, and James J. Grant .....	275
4446	Stability Analysis and Tuning of PID Controller in VAV Systems Masato Kasahara, Takanori Yamazuki, Yoshiaki Kuzuu, Yukihiro Hashimoto, Kazuyuki Kamimura, Tadahiko Matsuba, and Shigeru Koruso .....	285
4447	The Nulling Test: A New Measurement Technique of Estimating Duct Leakage in Residential Homes Paul W. Francisco and Larry S. Palmiter.....	297
4448	<i>(International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research)</i> Theoretical Performance Comparison of CO <sub>2</sub> Transcritical Cycle Technology Versus HCFC-22 Technology for a Military Packaged Air Conditioner Application Douglas M. Robinson and Eckard A. Groll .....	304
4449	<i>(International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research)</i> Theory of Heat/Mass Transfer Additives in Absorption Chillers Satheesh Kulankara and Keith E. Herold .....	305
4450	(RP-1011) Utility/Customer Information Services, Part 1: Descriptions of Services and Discussion on Interoperability for Service Implementation Michael Kintner-Meyer and Martin J. Burns .....	306
4451	(RP-1011) Utility/Customer Information Services, Part 2: Data Object Modeling and Mapping to BACnet™ Michael Kintner-Meyer and Martin J. Burns .....	314
4452	Validation of EHD-Enhanced Nucleate Boiling Correlation Christopher C. Pascual, Jorg H. Stromberger, Sheldon M. Jeter, and Said I. Abdel-Khalik .....	326
4453	<i>(International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research)</i> Wetting Coatings for Dehumidifying Heat Exchangers Kwangtaek Hong and Ralph L. Webb .....	337

4454	Local Heat Transfer Characteristics of Louvered Plate Fin Surfaces Chang Duk Jeon and Jinho Lee.....	338
4455	Ice Slurry Cooling Research: Effects of Microscale Ice Particle Characteristics and Freezing-Point-Depressant Additives on Slurry Fluidity Kanetoshi Hayashi and Ken E. Kasza .....	346
4456	<i>(International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research)</i> Fault Diagnosis in Air-Conditioning Systems: A Multi-Step Fuzzy Model-Based Approach A.L. Dexter and D. Ngo .....	352

## SYMPOSIUM PAPERS

### **AT-01-1 Case Studies and Modeling for Heating Systems in Special Function Buildings and Residences with Special Emphasis on Radiant Panel Systems**

Heating of Church Buildings of Historic Importance with Direct Gas-Fired Heating Systems Weizhong Xiang, Savvas Tassou, and Maria Kolokotroni .....		357
Impact of Dual Utility Selection on 305 m <sup>2</sup> (1000 ft <sup>2</sup> ) Residences Richard D. Watson, Kirby S. Chapman, and Linda Wiggington .....		365
An Analysis of Combined CFD and Multizone IAQ Model Assembly Issues Amy Musser .....		371
Radiant Panel Surface Temperature Over a Range of Ambient Temperatures Kirby S. Chapman, Jamie Howell, and Richard D. Watson .....		383
Hybrid Heating and Ventilating of Industrial Facilities Connected to District Energy System Dušan Petráš .....		390

### **AT-01-2 Central Energy Plant kW Per Ton and Demand Controls**

The Measurement of Energy Consumption in kW Per Ton for Central Chilled Water Plants James B. (Burt) Rishel .....		397
Measurement Considerations for the Determination of Central Plant Efficiency Stephen J. Treado and Todd Snouffer .....		401
Instrumentation Issues for Monitoring Chiller Plant Efficiency Thomas B. Hartman .....		407

### **AT-01-3 Innovative Materials and Building Envelope Systems**

Performance of Innovative Vapor Retarders Under Summer Conditions Hartwig M. Küenzel and Hans-Peter Leimer .....		417
Advances in Residential Wall Technologies—Simple Ways of Decreasing the Whole Building Energy Consumption Jan Kosny .....		421
Development of a Textured Spun-Bonded Polyolefin Water Barrier for Stucco and EIFS Theresa A. Weston, Michel Stachnik, and James Waggoner .....		433
Indoor Air Quality and Hygroscopically Active Materials J.F. Straube and J.P. deGraauw .....		444

<b>AT-01-4</b>	<b>Absorption/Sorption Heat Pumps and Refrigeration Systems</b>	
	Numerical Study of Absorption in a Laminar Falling Film of Ammonia-Water Khaled Gommed, Gershon Grossman, and Michael S. Koenig .....	453
	Surface Tension of Aqueous Lithium Bromide with Controlled Vapor Concentration of 2-Ehtyl-Hexanol Z. Yuan and K.E. Herold.....	463
	Effective Lift Characterization of GAX Cycles G. Anand and D.C. Erickson .....	469
<b>AT-01-5</b>	<b>Analysis Tools for the Design of Low Energy Cooling Systems</b>	
	Night Ventilation Cooling of Office Buildings: Parametric Analyses of Conceptual Energy Impacts Maria Kolokotroni.....	479
	Desiccant Cooling for Swedish Office Buildings Johnny V. Andersson and Torbjörn Lindholm .....	490
	Pre-Design and Design Tools for Evaporative Cooling Pascal Stabat, Dominique Marchio, and Matthieu Orphelin .....	501
	Guidance and Tools for Night and Evaporative Cooling in Office Buildings Jean-Robert Millet .....	511
<b>AT-01-6</b>	<b>TES Systems Aging Gracefully</b>	
	University Hospital Chilled Water Thermal Storage—Still Meeting the Challenges Gordon V.R. Holness.....	525
	Long-Term Experience with External-Melt Ice-on-Coil Storage Cooling System Chang W. Sohn and Jack L. Nixon.....	532
	Reedsburg Technical College Ice Maker Heat Pump Charles E. Dorgan .....	538
<b>AT-01-7</b>	<b>Integration of Dedicated Outside Air Dehumidification Systems and Terminal Sensible Cooling/Heating</b>	
	Overview of Integrating Dedicated Outdoor Air Systems with Parallel Terminal Systems Stanley A. Mumma .....	545
	Achieving Dry Outside Air in an Energy-Efficient Manner Stanley A. Mumma and Kurt M. Shank .....	553
	Selecting the Supply Air Conditions for a Dedicated Outdoor Air System Working in Parallel with Distributed Sensible Cooling Terminal Equipment Kurt M. Shank and Stanley A. Mumma .....	562
	Integration of Hydronic Thermal Transport Systems with Fire Suppression Systems Walter M. Janus.....	572
	Ceiling Radiant Cooling Panels as a Viable Distributed Parallel Sensible Cooling Technology Integrated with Dedicated Outdoor Air Systems Christopher L. Conroy and Stanley A. Mumma .....	578

<b>AT-01-8 Pumping Design and Performance Modeling of Geothermal Heat Pump Systems</b>	
Energy Use of Pumping Options for Ground-Source Heat Pumps Stephen P. Kavanaugh and Sally A. McNerny .....	589
Dual Set Point Control of Open-Loop Heat Pump Systems Kevin D. Rafferty .....	600
Ground-Coupled Heat Pump System Simulation Michel A. Bernier .....	605
Field Validation of a Short Time Step Model for Vertical Ground-Loop Heat Exchangers Cenk Yavuzturk and Jeffrey D. Spitler .....	617
<b>AT-01-9 Thermoeconomics and Second Law Analysis of HVAC&amp;R Systems</b>	
Thermoeconomic Analysis of Absorption Systems for Cooling Shun-Fu Lee and S.A. Sherif .....	629
Thermoeconomics Applied to Air-Conditioning Systems Miguel Angel Ferrer, Miguel Angel Lozano, and Robert Tozer .....	638
Second Law Analysis of Refrigerators and Air Conditioners Brian D. Bridges, Derek S. Harshbarger, and Clark W. Bullard .....	644
Thermoeconomic Analysis of Absorption Heat Transformers Shun-Fu Lee and S.A. Sherif .....	652
Second Law Analysis of Various Double-Effect Lithium Bromide/Water Absorption Chillers Shun-Fu Lee and S.A. Sherif .....	664
<b>AT-01-10 Characterizing the Performance of Non-Simple Fenestrations: Special Problems in Shaded and Projecting Products</b>	
The Effects of Calorimeter Tilt on the Inward-Flowing Fraction of Absorbed Solar Radiation in a Venetian Blind Michael R. Collins and Stephen J. Harrison .....	677
Effect of Tilt Angle and Temperature Difference on Solar Heat Gain Coefficient Measurement of Fenestration System Ching-Chia (Thomas) Tseng and D. Yogi Goswami .....	684
Test of Measured Solar Heat Gain Variation in a Fenestration and Shade Combination with Respect to Test Specimen Tilt Michael R. Collins and Stephen J. Harrison .....	691
A Simplified Analysis of Radiant Heat Loss Through Projecting Fenestration Products John L. Wright .....	700
<b>AT-01-11 Smoke Management Research and Case Studies of Large Spaces</b>	
CFD Simulation in Atrium Smoke Management System Design Ray Sinclair .....	711
The Smoke Hazard from a Fire in High Spaces (RP-899) Gary D. Lougheed and George V. Hadjisophocleous .....	720

Sprinklered Mercantile Fires (RP-976) Gary D. Loughheed, Cameron McCartney, and Bruce C. Taber.....	730
Case Study of a Fire Engineering Approach to a Large, Unsprinklered Naturally Ventilated Atrium Building Frank A. Mills.....	744
<b>AT-01-12 Effects of International Building Code 2000 on Seismic Design for HVAC</b>	
Maneuvering Through the Maze of Seismic Building Codes and Guides Robert E. Simmons .....	755
How to Use the New Codes in Moderate Seismic Areas Patrick J. Lama.....	769
Static Modeling of Equipment Acted on by Seismic Forces Paul W. Meisel.....	775
<b>AT-01-13 Modeling and Measurement of VOC Emissions from Building Materials</b>	
Correlations Between the Internal Diffusion and Equilibrium Partition Coefficients of Volatile Organic Compounds (VOCs) in Building Materials and the VOC Properties A. Bodalal, J.S. Zhang, E.G. Plett, and C.Y. Shaw .....	789
Effects of Airflow on VOC Emissions from “Wet” Coating Materials: Experimental Measurements and Numerical Simulation Xudong Yang, Qingyan Chen, Jie Zeng, Jianshun Zhang, Gang Nong, and Chia-Yu Shaw .....	801
Distribution of Chemical Pollutants in a Room Based on CFD Simulation Coupled with Emission/Sorption Analysis Shuzo Murakami, Shinsuke Kato, Kazuhide Ito, Akira Yamamoto, Yasushi Kondo, and Jun-ichi Fujimura .....	812
The Impact of Combinations of Building Materials and Intermittent Ventilation on Perceived Air Quality Fariborz Haghighat, Wafa Sakr, Lars Gunnarsen, and Michael Von Grunau .....	821
<b>AT-01-14 Recent Results from Fault Detection and Diagnostic Research</b>	
Model-Based Fault Detection and Diagnosis for Cooling Towers Byung-Cheon Ahn, John W. Mitchell, and Ian B.D. McIntosh .....	839
Simple Rule-Based Methods for Fault Detection and Diagnostics Applied to Packaged Air Conditioners Bin Chen and James E. Braun .....	847
( <i>International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research</i> ) Fault Diagnosis in Air-Conditioning Systems: A Multi-Step Fuzzy Model-Based Approach Arthur L. Dexter and Darious Ngo	
(See Technical Paper 4456, p. 352)	
An Expert Rule Set for Fault Detection in Air-Handling Units John M. House, Hossein Vaezi-Nejad, and J. Michael Whitcomb.....	858
<b>AT-01-15 Combustion Turbine Inlet Cooling: Creative Applications and Advances in the Technology</b>	
A Hybrid System for Combustion Turbine Inlet Air Cooling at a Cogeneration Plant in Pasadena, Texas Dharam V. Punwani, Tom Pierson, James Bagley, and William A. Ryan .....	875

A New Approach to Turbine Inlet Air Cooling Edison Tito Guimarães .....	882
Condensation and Icing in Gas Turbine Systems: Inlet Air Temperature and Humidity Limits William E. Stewart, Jr. ....	887
Combustion Turbine Inlet Air Cooling (CTIAC): Benefits and Technology Options in District Energy Applications John S. Andrepont .....	892

**AT-01-16 Advances in Thermal and Fluid Flow Characteristics of HVAC and Refrigeration Processes**

Thermal Performance of Flooded Evaporators, Part 1: Review of Boiling Heat Transfer Studies (RP-1089) Sergio Casciaro and John R. Thome .....	903
Thermal Performance of Flooded Evaporators, Part 2: Review of Void Fraction, Two-Phase Pressure Drop, and Flow Pattern Studies (RP-1089) Sergio Casciaro and John R. Thome .....	919
Local Heat Transfer Characteristics of Louvered Plate Fin Surfaces Chang Duk Jeon and Jinho Lee  (See Technical Paper 4454, p. 338)	
Ice Slurry Cooling Research: Effects of Microscale Ice Particle Characteristics and Freezing-Point-Depressant Additives on Slurry Fluidity Kanetoshi Hayashi and Ken E. Kasza  (See Technical Paper 4455, p. 346)	

Index of Technical and Symposium Papers, Volume 107, part 1 .....	931
---	-----

**Society Business will be published in Part 2 of *ASHRAE Transactions*, Volume 107.**