

**AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND  
 AIR CONDITIONING ENGINEERS, INC.**

1791Tullie Circle, NE / Atlanta, GA30329  
 (404) 636-8400

**TC/TG/TRG MINUTES COVER SHEET**

(Minutes of all TC/TG/TRG Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/TRG NO.:	<b>4.10</b>		TC/TG/TRG TITLE:	<b>INDOOR ENVIRONMENTAL MODELING</b>			
DATE OF MEETING:	June 24, 2018		LOCATION:	Houston, TX			
DATE ISSUED:	July 31, 2018		RECORDED BY:	James Lo			
VOTING MEMBERS	TERM		PRESENT	OFFICERS		TERM	
	On	Off				On	Off
Zhang, Tim	16	20	X	Chair	Koupriyanov, Mikhail	17	19
Koupriyanov, Mikhail	16	20	✓	Vice Chair	Zuo, Wangda	17	19
Bennet, Jamie	16	20	✓	Secretary	Lo, James	17	19
Lin, Charlie	16	20	✓	Programs	VanGilder, Jim	17	19
Leon Wang	17	21	X	Research	Lin, Charlie	17	19
Rim, Donghyun	17	21	✓	Handbook	Lo, James	13	18
Zuo, Wangda	17	21	✓	Membership	Wang, Leon	18	20
Lin, Chao-Hsin	17	21	✓	Web Page	Lo, James	13	N/A
Dols, Stuart	17	21	✓	Honors and Awards	Lin, Chao-Hsin	16	N/A
Chen, QingYan	17	21	✓	ALI	Zhai, John	04	N/A
Xudong Yang	17	21	✓				
Lo, James	14	18	✓				

**Attendance List: See Appendix B**

Technical Committee 4.10 – Indoor Environmental Modeling  
 These minutes are a **DRAFT** until voted upon by the committee.

<b>Society Liaisons, etc.</b>		<b>PRESENT</b>
Wessel, Dennis	TAC Section Head	✓
Mike Pouchak	RAC Research Liaison	✓
Meredith, David	Prof. Devt. Committee	
James Aswegan	Standards Liaison	
Hosni, Mo	Program Liaison	
Bahnfleth, William	TAC Chairman	
Ferguson, Kimball	Special Publications Liaison	
Ramspeck, Claire	Staff Liaison (Standards)	
Gulledge, Charles E.	TEGA Liaison	
Vaughn, Michael	Staff Liaison (Research)	
Larry Ackers	Handbook Liaison (Fundamental)	
Harris Sheinman	Handbook Liaison (Applications)	

**Call to order by Chairman:** (Mike Koupriyanov) at 2:15 p.m.

**Welcome by Chair**

**Self-Introductions of attendees**

**Roll call** (Mike Koupriyanov) – voting members

Zhang, Tim (int.)	X	Xudong, Yang (int.)	✓
Koupriyanov, Mikhail	✓	Lo, James	✓
Bennet, Jamie	✓	Lin, Chao-Hsin	✓
Stuart Dols	✓	Leon Wang (int.)	X
Wangda Zuo	✓	Rim, Donghyun	✓
Yan Chen	✓	Lin, Charlie	✓

**Attendance**

- **9 of 9** non-international voting members were present
- **1 of 3** international voting members were present
- **Quorum achieved** without counting the Chair
- Non-voting officers present: Jim VanGilder

**Minutes from Las Vegas meeting**

- Call Approval of Houston minutes
  - **Vote: (9-0-1)**
  - **Minutes approved**

**ASHRAE Staff**

- ASHRAE standard committee is looking for experts in reviewing standards in different areas, especially international members.
- Minutes especially research minutes should be forwarded to [RL4@ASHRAE.net](mailto:RL4@ASHRAE.net)

**Section Head** (Wessel, Dennis):

- Potential new TC on resiliency and disaster prevention
- ASHRAE 125 Anniversary Historical session for Houston Summer meeting

**Announcements**

- TC should reaffirm the mission statement/scope every few years and vote on it
- Online roster update is now available

**Membership** (Jim VanGilder)

- Officers (Starting from July 2018)
  - Donghyun Rim will replace James Lo as Application Chapter Chair starting July 2018. James remains until then due to the completion of the application handbook chapter.
  - Leon Wang replaced Reza Ghias starting in this Meeting.
- Voting Members
  - Rolling off (July 2018): James Lo, Chao-Hsin Lin, Reza Ghias
  - Rolling on (July 2018): Leon Wang, Duncan Phyfe, Jim Van Gilder

**Standards/Guidelines** (Mike Koupriyanov)

N/A

**Research** (Charlie Lin)

The research subcommittee met on Sunday (06/24) at 5:00-6:00 pm. There were 20 attendees in the meeting. Revolving submission deadlines: March 15, May 15<sup>th</sup>, August 15<sup>th</sup>, and December 15<sup>th</sup>.

**Current Status of TC 4.10 RTARs, WSs, and Projects.**

<b>Projects</b>	<b>PMS</b>	<b>Title</b>	<b>Status</b>
1675-RP	Jim, Mark, John, (Greg), Wangda	Guidance for CFD Modeling of Data Centers	<ul style="list-style-type: none"> <li>Subcontract being processed</li> <li>First sever simulator received</li> </ul>
<b>Bidding</b>	<b>PMS</b>	<b>Title</b>	<b>Status</b>
			No project for bidding this time
<b>WSs</b>	<b>Author(s)</b>	<b>Title</b>	<b>Status</b>
1744	Malcolm Cook, James Lo, Jordan Clark, Duncan, and Mike	Guidelines for Accurate CFD Modeling of Natural Ventilation	<ul style="list-style-type: none"> <li>Comments received from RAC 10/28/2016</li> <li>WS to be revised/voted and submitted</li> <li>Target Aug. 15 submission</li> </ul>
1827	Ray Horstman	Particle Inhalation Modeling of Aircraft Cabins as Sparse Non-uniform Spaces Phase I	<ul style="list-style-type: none"> <li>RL agreed WS development</li> <li>WS drafted</li> <li>To be voted on in Houston</li> </ul>
<b>RTARs</b>	<b>Author(s)</b>	<b>Title</b>	<b>Status</b>
1828	Chao-Hsin Lin, James	Flow Characteristics of Installed Flex Ducts	<ul style="list-style-type: none"> <li>RTAR submitted to RAC 05/15/2017, not accepted</li> <li>To be revised with co-sponsorship from TC 5.2/5.3</li> <li>Chao-Hsin to coordinate the discussions</li> <li>New version planned before next meeting</li> </ul>
New	Ray Horstman	Compensating for Sky Temperature Using Indoor Environmental Modeling of Environmental Test Chambers	<ul style="list-style-type: none"> <li>Was not submitted to RAC Liaison suggestions</li> <li>Revised version received with a new title and clarified scope.</li> <li>More discussions are needed.</li> <li>Charlie to communicate with Ray about it.</li> </ul>
New	Donghyun Rim, Anthony Fontanini, Leon	Constructing Surrogate and Reduced Order Models for Stratified Flows	<ul style="list-style-type: none"> <li>RTAR drafted 06/25/2017</li> <li>Revision to be done based on discussions</li> <li>To be sent to TC 4.10 members</li> </ul>

Technical Committee 4.10 – Indoor Environmental Modeling  
 These minutes are a **DRAFT** until voted upon by the committee.

New	Tengfei (Tim) Zhang	Water Vapor Condensation on Building Skins Considering Seasonal and Diurnal Meteorological Condition	<ul style="list-style-type: none"> <li>Discussed in the meetings</li> <li>To be revised</li> </ul>
New	Jim VanGilder	Indoor Environmental Modeling with an Enhanced Potential Flow Model	<ul style="list-style-type: none"> <li>RTAR on hold due to patent related reasons</li> <li>To talk to Mike Vaugh</li> </ul>

Co-Sponsorships on RTAR/WS

- Co-Sponsor SSPC 62.1 “Determining Emission Rates of Volatile Organic Compounds in Offices and Their Impact on Perceived Indoor Environmental Quality” (Author: Lisa Ng). Similar to RP-1596. TC 2.8 is also involved. Xudong Yang is interested. Less than \$200k. To be voted on in Houston.
- Co-sponsor WS 1748 “Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase 2)” (led by TC 4.7, Authors: Tony Fontanini, Joe Huang). The WS has received comments from RAC for revision/re-submission. To be voted and submitted in Houston.
- Co-sponsor “WS 1730 – Research to Determine The Pressure Coefficients & Pressure Drop For Standard Venting Strategies & Components In Attic Spaces With Sloped Roofs” (led by TC 4.4, Authors: Anthony Fontanini and Roodvoets). Still in discussions, 1st draft WS is written and is targeted for vote in TC 4.4 in Las Vegas. Project title changed. Anthony to check with TC 4.4 to see whether TC 4.10 co-sponsorship is still needed. No CFD needed.

New Ideas:

- Radiation model in CFD, possible co-sponsorship from TC 6.5. (Mike Koupriyanov, Reza Ghias). RTAR to be developed.
- Mixed mode ventilation: CFD and thermal comfort (Mahroo Eftekhari). RTAR will be developed. Malcolm to contact Mahroo.
- Ventilation effectiveness by SSPC 62.1, looking for co-sponsor with TC 4.10, possible RTAR in the next couple of weeks (Malcolm).
- CFD modeling of chemical reaction in building. With experimental data. (Donghyun, Atila, Shamia). RTAR to be developed.
- Benchmark cases for CFD (Jim, Mike, James, Duncan). Being discussed.
- Open source CFD (Jim, Mike). To be worked on after completion of handbook.

**Handbook** (James Lo)

The Handbook subcommittee met on Sunday (06/23) from 3:00 to 4:00 pm. There were **10** attendees.

- New draft sent out 7/2
- Comments are due 7/13
- Online meeting for final draft 7/20
- Final vote 7/30, submission 7/31
- TC voted 10-0-0 for the above timeline, and voted 9-0-3 to approve draft submission (7/30 email ballot)

**Program** (James VanGilder)

The Program Subcommittee met on Sunday (06/23) from 4:00-5:00pm.

<b>Houston, Summer 2018</b>
-----------------------------

Technical Committee 4.10 – Indoor Environmental Modeling  
 These minutes are a **DRAFT** until voted upon by the committee.

Session Type	Session Title	Session Chair	Speakers
Seminar	Faster, Cheaper, More Accessible: The Latest Research in Airflow and Thermal Modeling of Indoor Environments Monday 6/25	Jim VanGilder	Dustin Demetriou Wangda Zuo Yan Chen Leon Wang
Seminar	High CO <sub>2</sub> (other contaminants) levels in schools Sunday 6/24	Donghun Rim	Atila Novoselac Som Shetha Xudong Yang Ramin Rezaei Duncan Phyfe
Seminar	Inverse Modeling Monday 6/25	Leon Wang	Yan Chen Tim Zhang Yan Chen

**Atlanta, Winter 2019**

Session Type	Session Title	Session Chair	Speakers
Seminar	Transient Temperature Changes in the Data Center: Should We Be Worried? (Led by TC9.9, TC4.10 co-sponsor)	Nick Gangemi	Jim VanGilder Mark Seymour ES2 Speaker TBD Leon Wang (FDS)
Seminar	Challenge of using Open Source CFD tools	Mike Koupriyanov	Stuart Dols (Zonal Modelimg) Yan Chen (OpenFOAM) Duncan Phyfe (OpenFOAM) Wangda Zuo (FFD)
Seminar	Balancing energy and effectiveness	Gang Tan	Mark Seymour (data center) Wangda Zuo (HVAC thermostat) Jamie Bennett Xudong Yang (Dynamic energy consumption)
Seminar	Modeling Megastructures, Arenas, etc. Leon: Tunnel Mike: Large lobby	Duncan Phyfe	Leon Wang (Tunnel) Mike Koupriyanov (Large Lobby)

**Kansas City, Summer 2019**

Session Type	Session Title	Session Chair	Speakers
Seminar	Modeling Reactive Surfaces in Indoor Environments	Ez Khalifa	Gang Tan Donghyun Rim Duncan Phyfe Atila Novoselac
Seminar	Modeling transient events for the indoor environment	Duncan Phyfe	Wangda Zuo (HVAC control) Mike Koupriyanov (Office, radiant slab) Donghyun Rim (chemical reactions) James Lo (wind) Duncan Phillips Jim VanGilder Dahai Qi (PCM Thermal storage)
Seminar	Aircraft Cabins	Jamie Bennett	Mo Hosni Jamie Bennett Ray Horstman Yan Chen

Technical Committee 4.10 – Indoor Environmental Modeling  
 These minutes are a **DRAFT** until voted upon by the committee.

			Tim Zhang Leon Wang
Seminar	Chilled Beams	Mike Koupriyanov	Mike Koupriyanov John Zhai Yan Chen
Seminar	Old School CFD, modeling judgment, Moore's Law, 2D applications		

Future Conferences			
Session Type	Session Title	Session Chair	Speakers
Seminar	Modeling Melting and Freezing	Ez Khalifa	Gang Tan (TEC, phase change)
Seminar	Ventilation Effectiveness Definition Confusion	Malcolm Cook	Kishor Khankari (MTG Chair) Mike Koupriyanov Duncan Phillips

**Deadlines**

Conference	Type	Seminar	Conference Paper Abstract Technical Paper	Conference Paper
<b>Atlanta 2019</b>	Winter	Aug 3, 2018	Mar 26, 2018	Jul 9, 2018
<b>Kansas City 2019</b>	Summer	Feb 2019	Aug 2018	Dec 2018
<b>Orlando 2020</b>	Winter	Aug 2019	Mar 2019	Jul 2019

**Web site activity (James Lo):**

- N/A

**Report of relevant activities in other TCs**

- TC1.2 *Instruments and Measurements* - Arsen Melikov
- TC2.1 *Physiology and Human Environment* – Arsen Melikov, Ray Horstman
- TC2.3 *Gaseous Air Contaminants/Removal Equipment*
- TC2.4 *Particulate Air Contaminants/Removal Equipment*
- TC2.6 *Sound and Vibration Control*
- TC4.3 *Ventilation Requirements and Infiltration* – Leon Wang
- TC4.7 *Load Calculation and Energy Modeling*
- TC5.3 *Room Air Distribution* - John Zhai
- TC5.6 *Control of Fire and Smoke* – Kai Kang
- TC9.2 *Industrial Air Conditioning and Ventilation*–Duncan Phyfe
- TC9.3 *Transportation* - Ray Horstman
- TC9.6 *Healthcare Facilities* – James Mcneil
- TC9.9 *Mission Critical Facilities* – Jim VanGilder
- Standard 55 *Thermal Environmental Conditions for Human Occupancy*
- Standard 62.1 *Ventilation for Acceptable Indoor Air Quality* – James Lo
  - New 62.1 revision for 2019 will include revised natural ventilation procedure which provides better guidelines in engineered systems. It is currently under public review.

**Honors and Awards (Chao-Hsin)**

Technical Committee 4.10 – Indoor Environmental Modeling  
These minutes are a **DRAFT** until voted upon by the committee.

Nominate Jensen for research award

**New Business**

N/A

**Agenda Suggestions for Next Meeting**

N/A

**Call to adjourn by chair:** (Mike) at 4:05 p.m. Vote 10-0-0.

**APPENDIX A: DESCRIPTION OF TC'S SCOPE (FROM WEBSITE)**

TC 4.10 is concerned with developing, evaluating and recommending procedures for predicting indoor environmental conditions including thermal, acoustical, illumination, and air quality for new or existing buildings.



**Appendix B:** Attendance list

<b>Name</b>	<b>Affiliation</b>	<b>Email</b>
Donghyun Rim	Penn State	<a href="mailto:drim@psu.edu">drim@psu.edu</a>
Yan Chen	Purdue U	<a href="mailto:yanchen@purdue.edu">yanchen@purdue.edu</a>
Wangda Zuo	University of Colorado Boulder	<a href="mailto:wangda.zuo@colorado.edu">wangda.zuo@colorado.edu</a>
Gang Tan	University of Wyoming	<a href="mailto:gtan@uwyoedu">gtan@uwyoedu</a>
Cheng-Xian (Charlie) Lin	FIU	<a href="mailto:lincx@fiu.edu">lincx@fiu.edu</a>
Xudong Yang	Tsinghua University	<a href="mailto:xyang@tsinghua.edu.cn">xyang@tsinghua.edu.cn</a>
Jason DeGraw	NREL	<a href="mailto:jason.degraw@nrel.gov">jason.degraw@nrel.gov</a>
Jeff Franklin	Airflow Sciences Corporation	<a href="mailto:jfranklin@airflowsciences.com">jfranklin@airflowsciences.com</a>
James Sweeney	Texas A&M Uni	<a href="mailto:jsweeney@tamu.edu">jsweeney@tamu.edu</a>
Jinchao Yuan	University of Idaho	<a href="mailto:jcyuan@uidaho.edu">jcyuan@uidaho.edu</a>
Ali Fallahi	Lawrence Tech University	<a href="mailto:afallahi@ltu.edu">afallahi@ltu.edu</a>
Shamia Hoque	University of South Carolina	<a href="mailto:hoques@cec.sc.edu">hoques@cec.sc.edu</a>
James Lo	Drexel University	<a href="mailto:james.lo@drexel.edu">james.lo@drexel.edu</a>
Jim VanGilder	Schneider Electric	<a href="mailto:jim.vangilder@schneider-electric.com">jim.vangilder@schneider-electric.com</a>
Leon Wang	Concordia University	<a href="mailto:leon.wang@concordia.ca">leon.wang@concordia.ca</a>
duncan phyfe	Alden	<a href="mailto:dphyfe@aldenlab.com">dphyfe@aldenlab.com</a>
Anuj Mistry	Daikin US Corporation	<a href="mailto:anuj.mistry@daikin.com">anuj.mistry@daikin.com</a>
Shen Yang	Tsinghua University	<a href="mailto:yangshen0925@yeah.net">yangshen0925@yeah.net</a>
Mohammad Heidarinejad	Illinois Institute of Technology	<a href="mailto:muh182@iit.edu">muh182@iit.edu</a>
Elizabeth Balke	Taylor Engineering	<a href="mailto:ecbalke@gmail.com">ecbalke@gmail.com</a>
Tim Zhang	Dalian U Tech, Tianjin U	<a href="mailto:tzhang@dlut.edu.cn">tzhang@dlut.edu.cn</a>
Chao-Hsin Lin	Boeing Company	<a href="mailto:Chao-Hsin.Lin@Boeing.com">Chao-Hsin.Lin@Boeing.com</a>
Mike Koupriyanov	Price Industries Ltd.	<a href="mailto:MikeK@priceindustries.com">MikeK@priceindustries.com</a>
Atila Novoselac	UT at Austin	<a href="mailto:atila@mail.utexas.edu">atila@mail.utexas.edu</a>