

# Aakash C. Rai

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## EDUCATION

- Ph.D.** in Mechanical Engineering (GPA: 3.74/4) *Sep 2010 – May 2014*  
Purdue University, West Lafayette, IN, USA
- B.Tech.** in Mechanical Engineering (GPA: 7.59/10) *Jul 2004 – Jul 2008*  
Indian Institute of Technology (IIT), Kharagpur, WB, India
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## PROFESSIONAL APPOINTMENTS

- Assistant Professor**, Department of Mechanical Engineering, Birla Institute of Technology & Science (BITS), Pilani, Rajasthan, India *Nov 2017 onwards*
- Research Fellow**, Department of Civil and Environmental Engineering, University of Surrey, Guildford, Surrey, UK *Sep 2016 – Oct 2017*
- Research Engineer**, Global Research Center, General Electric (GE), Bengaluru, Karnataka, India *Jun 2014 – Aug 2016*
- Graduate Research Assistant**, School of Mechanical Engineering, Purdue University, West Lafayette, IN, USA *Sep 2010 – May 2014*
- Scientist B**, Combat Vehicles R&D Establishment (CVRDE), DRDO, Chennai, TN, India *Dec 2008 – Aug 2010*
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## RESEARCH INTERESTS

1. Energy-efficient buildings.
  2. Impact of climate change on energy consumption in buildings.
  3. Air pollution measurements, modeling, and control.
  4. Development of low-cost devices for air pollution management.
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## PROFESSIONAL APPOINTMENTS

**Assistant Professor at BITS-Pilani** *Nov 2017 onwards*

### Courses Taught

<i>S. No.</i>	<i>Course</i>	<i>Type (L/T/P)</i>	<i>Level (UG/PG)</i>	<i>Feedback</i>
1.	Thermodynamics	L and T	UG	8.5/10
2.	Applied thermodynamics	L, T, and P	UG	9.2/10
3.	Operations research	L and T	UG	7.1/10
4.	Refrigeration and air-conditioning	L	UG	8.7/10
5.	Heat transfer	P	UG	8.5/10
6.	Heating and cooling of buildings	L	PG	8.7/10

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L: Lecture, T: Tutorial, P: Practical, UG: Under-graduate, and PG: Post-graduate.

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#### Ph.D. Thesis Supervisions

<i>S. No.</i>	<i>Scholar Name</i>	<i>Topic</i>	<i>Duration</i>
1.	Rahul Ukey	Assessment and mitigation of impact of climate change on heating and cooling energy consumption in buildings	2018–23
2.	Mukesh Budaniya	Assessment of indoor plants for improving air quality in buildings	2019–24
3.	Deepali Agrawal	Evaluation of low-cost sensors for monitoring personal exposure to airborne particulate matter	2020–25
4.	Vivek Tiwari*	Design and development of high-temperature latent heat thermal energy storage for power generation	2017–22

\*Dr. Rai is the co-supervisor.

#### Masters Dissertation Supervisions

<i>S. No.</i>	<i>Student Name</i>	<i>Topic</i>	<i>Duration</i>
1.	Rishabh Gupta	Impact of global warming on heating and cooling degree days in major Indian cities	2020
2.	A Aravinda De Chinnu	Impact of climate change on the heating and cooling energy consumption in residential buildings in India	2020

#### Funded Research Projects

<i>S. No.</i>	<i>Title</i>	<i>Role</i>	<i>Duration</i>	<i>Funding agency</i>	<i>Amount (lakh ₹)</i>
1.	BITS Outstanding Potential for Excellence in Research and Academics (OPERA) award	PI	2017–22	BITS	19.80
2.	Assessment of indoor plants for improving air quality in buildings	PI	2019–22	SERB	39.71
3.	Development of a reliable, low-cost, portable, IoT-enabled, optical device for measuring PM <sub>2.5</sub> concentration in air	PI	2020–22	DST	35.96
4.	Improved design methodology for high-temperature thermal energy storage systems for concentrated solar power plants	PI	4 weeks travel grant	EU-SFERA	2.00

Total = 97.47

PI: Principal Investigator, BITS: Birla Institute of Technology & Science, SERB: Science and Engineering Research Board, DST: Department of Science and Technology, and EU-SFERA: European Union's Solar Facilities for the European Research Area.

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**Research Fellow at the University of Surrey***Sep 2016 – Oct 2017*

Research project: Smart Monitoring and Control of Air Pollution through Low-cost Sensors and Green Infrastructural Intervention

- Reviewed the performance of low-cost sensors for monitoring gaseous and particulate air pollutants.
- Conducted field measurement for assessing the effectiveness of green infrastructural interventions (trees, hedges, etc.) in controlling air pollution.

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**Research Engineer at General Electric (GE)***Jun 2014 – Aug 2016*

Research project: Flow and Thermal Analysis of Gas Turbines

- Invented a new method for reducing labyrinth seal leakages in gas turbines. This new technology is being patented and implemented in several different gas turbines.
- Developed advanced CFD based models for improving thermal and flow predictions in rotor-stator cavities, bore-tubes, and nozzle cavities.

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**Graduate Research Assistant at Purdue University***Sep 2010 – May 2014*

Research project: Ozone-initiated Chemistry in Indoor Environment

- Discovered particle generation from ozone reactions with human-worn clothing through experimental measurements.
- Predicted that ozone/clothing reactions could be a significant source of ultrafine particles in aircraft cabins by using a population-balance model.
- Quantified the impact of different factors (humidity, ozone concentration, etc.) on Volatile Organic Compound (VOC) and particle generations from ozone/clothing reactions through experimental measurements.
- Improved the exposure assessment of aircraft passengers to ozone and ozone-initiated VOCs by computing their breathing zone concentrations using CFD.

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**Scientist B at CVRDE***Dec 2008 – Aug 2010*

Research project: Performance Modeling of Automotive Torque Converters

- Developed a CFD model for predicting the performance of automotive torque converters and validated the model against experimental data.

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**PUBLICATIONS AND PATENT**

Journal Articles (430+ citations, i10-index = 7, as of September 2021)

Google Scholar: [https://scholar.google.co.in/citations?user=k\\_RKxgYAAAAJ&hl=en](https://scholar.google.co.in/citations?user=k_RKxgYAAAAJ&hl=en)

1. **Rai AC** and Chen Q, 2012. Simulations of ozone distributions in an aircraft cabin using computational fluid dynamics. *Atmospheric Environment (Impact factor = 4.798)* 54, 348–357, <https://doi.org/10.1016/j.atmosenv.2012.02.010>.
  2. **Rai AC**, Guo B, Lin C-H, Zhang J, Pei J, and Chen Q, 2013. Ozone reaction with clothing and its initiated particle generation in an environmental chamber. *Atmospheric Environment (Impact factor = 4.798)* 77, 885–892, <https://doi.org/10.1016/j.atmosenv.2013.05.062>.
  3. **Rai AC**, Guo B, Lin C-H, Zhang J, Pei J, and Chen Q, 2014. Ozone reaction with clothing and its initiated VOC emissions in an environmental chamber. *Indoor Air (Impact factor = 5.770)* 24, 49–58, <https://doi.org/10.1111/ina.12058>.
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4. **Rai AC**, Lin C-H, and Chen Q, 2014. Numerical modeling of volatile organic compound emissions from ozone reactions with human-worn clothing in an aircraft cabin. *HVAC&R Research (Impact factor = 1.990)* 20, 922–931, <https://doi.org/10.1080/10789669.2014.959428>.
  5. **Rai AC**, Lin C-H, and Chen Q, 2015. Numerical modeling of particle generation from ozone reactions with human-worn clothing in indoor environments. *Atmospheric Environment (Impact factor = 4.798)* 102, 145–155, <https://doi.org/10.1016/j.atmosenv.2014.11.058>.
  6. **Rai AC**, Kumar P, Pilla F, Skouloudis AN, Di Sabatino S, Ratti C, Yasar A, and Rickerby D, 2017. End-user perspective of low-cost sensors for outdoor air pollution monitoring. *Science of the Total Environment (Impact factor = 7.963)* 607, 691–705, <https://doi.org/10.1016/j.scitotenv.2017.06.266>.
  7. Sharma V and **Rai AC\***, 2020. Performance assessment of residential building envelopes enhanced with phase change materials. *Energy and Buildings (Impact factor = 5.879)* 208, 109664, <https://doi.org/10.1016/j.enbuild.2019.109664>.
  8. **Rai AC\***, 2021. Energy performance of phase change materials integrated into brick masonry walls for cooling load management in residential buildings, *Building and Environment (Impact factor = 6.456)* 199, 107930, <https://doi.org/10.1016/j.buildenv.2021.107930>.
  9. Ukey R and **Rai AC\***, 2021. Impact of global warming on heating and cooling degree days in major Indian cities. *Energy and Buildings (Impact factor = 5.879)* 244, 111050, <https://doi.org/10.1016/j.enbuild.2021.111050>.
  10. Tiwari V, **Rai AC\***, and Srinivasan P, 2021. Parametric analysis and optimization of a latent heat thermal energy storage system for concentrated solar power plants under realistic operating conditions. *Renewable Energy (Impact factor = 8.001)* 174, 305–319, <https://doi.org/10.1016/j.renene.2021.04.073>.
  11. De Chinnu A and **Rai AC**. Impact of climate change on the heating and cooling energy consumption in residential buildings in India. In preparation.
  12. Budaniya M and **Rai AC**. Effectiveness of indoor plants for passive removal of particulate matter in indoor environments. In preparation.

\*Dr. Rai is the corresponding author.

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#### Patent

1. Labyrinth seal system and an associated method thereof (Indian patent application # 6599/CHE/2015, published in June 2017).

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#### Conference Articles

1. **Rai AC** and Chen Q, 2012. Computational fluid dynamics modeling of ozone distributions in an aircraft cabin. International Conference on Energy and Environment, Boulder, CO, USA.
  2. **Rai AC**, Chen C, Lin C-H, and Chen Q, 2014. Numerical modeling of particle generation from ozone reactions with human-worn clothing in an environmental chamber. International Conference on Indoor Air Quality and Climate, Hong Kong.
  3. **Rai AC**, Lin C-H, and Chen Q, 2014. Modeling VOC emissions from ozone reactions with human-worn clothing in an aircraft cabin. International Conference on Indoor Air Quality and Climate, Hong Kong.
  4. Chen Q, **Rai AC**, and Lin C-H, 2016. Numerical modeling of VOC emissions from ozone reactions with human-worn clothing in an aircraft cabin. ASHRAE Winter Conference, Orlando, FL, USA.
  5. **Rai AC**, Prabhudharwadkar D, Murthy S, Giametta A, and Johns D, 2016. Effect of air-curtains on labyrinth seal performance. ASME Turbo Expo, Seoul, South Korea.
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6. **Rai AC** and Kumar P, 2017. Quantifying the reduction of air pollution by vegetation in urban areas. International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, Bologna, Italy.
  7. Budaniya M and **Rai AC\***, 2021. Phytoremediation of airborne particulate matter in indoor environments. Healthy Buildings Europe, Oslo, Norway.

\*Dr. Rai is the corresponding author.

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## TALKS AND PRESENTATIONS

1. The Horizon 2020 iSCAPE (Improving the Smart Control of Air Pollution in Europe) project aiming to develop sustainable and passive air pollution remediation strategies, policy interventions, and behavioral change initiatives across Europe. Presented on 3<sup>rd</sup> November 2016 to the London Region Pollution Study Group at the Chartered Institute of Environmental Health (CIEH), London, UK.
  2. Ozone-initiated chemistry and its impact on indoor air quality. Presented on 6<sup>th</sup> May 2014 at the RITE/ACER partners' meeting, Melbourne, FL, USA.
  3. CFD modeling of ozone distributions in an aircraft cabin. Presented on 12<sup>th</sup> March 2012 at the RITE/ACER partners' meeting, New Brunswick, NJ, USA.
  4. Assessment and mitigation of impact of climate change on the cooling energy consumptions in buildings. Presented on 25<sup>th</sup> August 2020 in an online short-term course conducted by NIT Silchar.
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## PROFESSIONAL ACTIVITIES

1. Editorial advisory board member of the international journal "Building and Environment" since 2019.
  2. Reviewer for international journals: i) Building and Environment, ii) Applied Energy, iii) Energy and Buildings, iv) Renewable Energy, v) Sustainable Energy Technologies and Assessments, and vi) Journal of Thermal Analysis and Calorimetry.
  3. Institute of repute representative from BITS-Pilani for National Clean Air Programme (NCAP).
  4. Indian Society of Heating, Refrigerating, and Air Conditioning Engineers (ISHRAE) member since 2019.
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## HONORS AND AWARDS

1. Distinction Award for paper presented in Healthy Buildings Europe 2021.
  2. Early Career Research Award in 2019 for pursuing innovative research in air pollution management.
  3. BITS OPERA Award in 2017 for outstanding potential for excellence in research and academics.
  4. GE Beliefs Award in 2016 for maturing a new labyrinth seal technology from the conceptual design stage to integration in several products.
  5. GE Above and Beyond Patent Award in 2016 for filing a patent on anew labyrinth seal design.
  6. GE Above and Beyond Award in 2015 for critically evaluating labyrinth seal designs with air-curtains.
  7. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Grant-in-Aid Honorarium in 2014 for paper publication in HVAC&R Research.
  8. ASHRAE Grant-in-Aid Award in 2013 for excellence in HVAC related education and research.
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## REFERENCES

1. Prof. Qingyan (Yan) Chen  
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