Abhinav Bhanawat

Contact Information

Final (Fifth) Year Student, B. Tech. – M. Tech. Dual Degree
Phase Change Thermal Systems Lab
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Education

- **Indian Institute of Technology (IIT) Kanpur, India**
  - Master of Technology, Mechanical Engineering, **CGPA – 9.57/10.0** ** (2018 – 2019)
  - Bachelor of Technology, Mechanical Engineering, **CGPA – 8.73/10.0** (2014 – 2018)
- **Green Valley Public School, Bhilwara, India**
  - 12th Grade, Central Board of Secondary Education, **Percentage – 94.6%** (2014)
- **St. Paul's Sr. Sec. School, Chittorgarh, India**
  - 10th Grade, Central Board of Secondary Education, **CGPA – 10.0/10.0** (2012)

*** Based on courses completed till now. Some courses ongoing*

Research Interests

- Solar Energy, Phase Change Heat Transfer, Energy Systems, Thermal Management
- Thermochemistry, Energy storage systems, Nanotechnology, Phase Change Materials

Conference papers

- **Bhanawat A.**, Yadav M. K., Punetha M., Khandekar S., "Effect of surface inclination on film condensation heat transfer in the presence of air", 27th International Conference on Nuclear Engineering, Japan, May 19-24, 2019 **(Accepted with minor revision)**
- Yadav M. K., **Bhanawat A.**, Punetha M., Khandekar S., "Steam condensation heat transfer inside reactor containment during the initial transient of a severe accident", 27th International Conference on Nuclear Engineering, Japan, May 19-24, 2019 **(Accepted with minor revision)**

Research Experience

M.TECH THESIS (May'18 – Present)

- **Steam condensation studies in the presence of Non-Condensable Gases (NCG) for nuclear containment cooling**
  Mentor: Dr. Sameer Khandekar, Phase Change Thermal Systems Lab, Dept. of Mechanical Engineering, IIT Kanpur
  - Performed experiments for filmwise condensation of steam for various parameters: Bulk pressure, NCG mass fraction, test surface inclination and wall subcooling
  - Analysed the effect of the above parameters on condensation heat transfer coefficient and heat flux
  - Used mass spectrometry to determine the composition of the bulk mixture of helium, air and steam
  - Submitted two technical papers, as listed in the previous section, for presentation and publication
- **Effect of plate inclination on dropwise condensation of steam on the plate**
  Mentor: Dr. Sameer Khandekar, Phase Change Thermal Systems Lab, Dept. of Mechanical Engineering, IIT Kanpur
  - Performed experimental runs for different parameters, with the plate inclination in each run varying from -90°(pendant mode) to +90°(sessile mode) in increments of ~15° *(Note: 0° indicates vertical plate)*
  - Analysed the variation of Heat transfer coefficient and heat flux with inclination angle
  - Rendered a video, compactly juxtaposing the recorded clips and processed results of selected angles for comparison
  - Ongoing work: Hydrophobic surface preparation and comparison of heat transfer in dropwise and filmwise modes

B.TECH (SENIOR YEAR) PROJECT [Poster]

- **Sugarcane/ Sweet Sorghum Syrup Making Machine** (Group of three) (Aug'17 – Apr'18)
  Mentor: Dr. Partha S. Ghoshdastidar, CFD Lab, Dept of Mechanical Engineering, IIT Kanpur
  - Designed and fabricated a semi-automatic machine that converts sugarcane juice into its syrup using waste sugarcane bagasse as fuel
  - Designed and Fabricated a Shell and Tube Heat Exchanger to quickly cool down the syrup from 110° C to 80° C, in just 2 minutes, for a better taste of syrup
  - Devised an innovative scum removal mechanism using a skimmer attached to chains and sprockets for continuous removal of impurities that rise to the surface of hot juice
  - Successfully demonstrated the working of machine to a committee of 4 faculty members from the Department of Mechanical Engineering

UNDERGRADUATE RESEARCH PROJECT

- **Design of a compressed-air run motor for refrigerant compressor** (Jan'17 – Apr'17)
  Mentor: Dr. Jishnu Bhattacharya, Energy Storage Systems Laboratory, Dept. of Mechanical Engineering, IIT Kanpur
  - Identified a suitable type (Vane air motor) for running the compressor in a standalone solar thermal refrigeration system
  - Analysed the effect of different parameters of the air motor like length of vanes, stator diameter, rotor diameter, angle of entry and exit, no. of vanes etc. on the overall output Torque and power
  - From the results, determined appropriate dimensions of the motor and used them to create a CAD model

RURAL RESEARCH AND DEVELOPMENT

- **Solar Water Purifier: Study and Documentation** (May'17 – July'17)
  Mentor: Dr. Anil K. Rajvanshi, Director, Nimbkar Agricultural Research Institute (NARI), Phaltan, India
  - Recorded temperature data and analyzed the temperature profile of water throughout the day
  - Made a CAD model using Autodesk Inventor and documented detailed part drawings and assembly information to facilitate its manufacturing
- **Scrutiny of food grain prices in India and proposal of appropriate price for remunerative farming** (May'17 – July'17)
  Mentor: Dr. Anil K. Rajvanshi, Director, Nimbkar Agricultural Research Institute (NARI), Phaltan, India
  - Investigated the current pricing of rice and wheat grains in Indian market and its ramifications
  - Proposed a new price for food grains and converged on it from different points of view.
  - Suggested a mechanism to sustain the new price. Work formed the basis of a blog article
- **Increasing the post-harvest storage time of tomatoes** (Group of 3) (Sept'15 – Nov'15)
  Mentor: Dr. Shikha Prasad, Dept. of Mechanical Engineering, IIT Kanpur
  - Took field trips and interacted with farmers in villages in Kanpur
  - Identified the main parameters affecting decay of tomatoes: temperature and moisture
  - Exploited the thermal energy storage properties of soil to build a low-cost underground storage facility in the village

Entrepreneurship: New Product Design & Prototyping (Course)

- **Stove Burner Shutoff Timer** (Group of seven) (Jan'17 – Apr'17)
  Mentor: Dr. Nachiketa Tiwari, Dept. of Mechanical Engineering, IIT Kanpur
  - Identified the need, conducted market research and made a working prototype of the product
  - Prepared a business plan consisting of an appropriate marketing strategy, financial projections (consisting of expected balance sheets) and the expected breakeven point for our hypothetical company

  Product Innovations:
  - An add-on device that can be used on all existing stoves
  - Turns the knob off, instead of just giving audio-visual prompts, after a pre-set time
  - Easy to use as the knob and timer dials are separate. The knob retains its original operation method
  - Gas leak sensor shuts off the burner in case of leakage and also sounds an alarm
  - Temperature sensor can be used to turn the knob off after a pre-set temp. is reached

Industrial Experience

Internship at Birla Cement Works, Chittorgarh, India (May'15 – June'15)
- Undertook a month-long industrial training to understand the overall operation of the cement plant
- Studied the working of Waste heat recovery system (WHRS) and other plant segments like Rotary Kiln, Packaging plant etc.
- Gained insights on industry standards and safety practices

Academic Projects

- **Design of Central Air Conditioning System for student's hostel** (Group of three) (Jan'17 – Apr'17)
  Mentor: Dr. Pradipta K. Panigrahi, Course: CAD of Thermal Systems
  - Studied two types of central air conditioning systems: direct expansion and chilled water. Used the latter for design.
  - Estimated the cooling loads of all the storeys of the hostel, accounting for heat generation, solar irradiation etc.
  - Accounted for the variable demand during the day and designed an appropriate duct network using EPANET
  - Optimised the design by choosing appropriate pumping power and dimension of ducts while ensuring minimal cost
- **Term paper on Precision Farming** (Jan'18 – Apr'18)
  Mentor: Dr. Anubha Goel, Course: Agricultural Sustainability and Climate Change
  - Investigated the latest technologies in agriculture like GIS, GPS, Variable Rate technologies, remote sensing, drones, etc.
  - Explored Precision Farming as a possible way to increase farm productivity and ensure cleaner environment

- **Term paper on Hot Carrier Solar Cells** (Aug'16 – Nov'16)
  Mentor: Dr. Sarang Ingole, Course: Solar Energy Technologies and Materials
  - Investigated the physics of Hot carrier solar cells, their working principle, the challenges they pose and assessed their potential in the future as compared to other solar cell technologies.
- **Term paper on Iso-geometric Analysis using T-splines** (Aug'17 - Nov'17)
  Mentor: Dr. Sanjay Mittal, Course: FEM for fluid dynamics
  - Explored T-splines as a basis for iso-geometric analysis over "NURBS", which is the Industry standard
  - Determined its current status, limitations and future possibilities

Skills

- **Programming:** C, FORTRAN, MATLAB, HTML
- **Graphics Editing:** ImageJ, Photoshop, Premiere Pro
- **CAD:** Autodesk Inventor, AutoCAD
- **Manufacturing:** CNC, Common Primary and Secondary techniques
- **Languages:** English (Fluent), Hindi (Mother Tongue)

Relevant Graduate Level Coursework

- **Mechanical Engineering Electives:** Solar Energy Technology, Conduction and Radiation, CFD and Heat Transfer, CAD of Thermal Systems, New Product Design and Prototyping, IC Engines, Combustion*, Boiling and Condensation*
- **Breadth Electives:** Solar Energy Technologies and Materials, Energy, Finite Element Methods for fluid dynamics, Agricultural Sustainability and Climate Change

* - Ongoing Courses

Awards, Scholarships and Achievements

- MHRD, India Fellowship for pursuing Master's studies at IIT Kanpur
- 'Academic Excellence Award' (twice) for outstanding academic performance at IIT Kanpur
- Merit-cum-means Scholarship (Awarded to meritorious and needy students at IIT Kanpur)
- 'Overall Best Student of the school' (Awarded to an individual for all-round performance in school in a year)
- All India Rank 907 amongst 150,000 candidates (top 0.6%) in JEE Advanced 2014
- School Topper in PCM stream in AISSCE 2014

Teaching Positions

- **Teaching Assistant, Course: Refrigeration and Air Conditioning** (Session: 2018-2019-I)
  Department of Mechanical Engineering, IIT Kanpur
  Conducted exams and quizzes, prepared course material and evaluated performance of over 35 students
- **Teaching Assistant, Course: Heat and Mass Transfer Laboratory** (Session: 2018-2019-II)
  Department of Mechanical Engineering, IIT Kanpur
  Conducted laboratory sessions and evaluated experiment reports of over 100 students

Extra – Curricular Activities

- **Music**
  - Performed as a **vocalist and guitarist** in music club events at IIT Kanpur
  - Composed medleys of songs from varied genres
- **Table Tennis**
  - Represented Chittorgarh district in the **state level tournament**
  - Led the school team, as a captain, to 2nd position in district level tournament
  - Selected for C.P.A (Compulsory Physical Activity) Table Tennis at IIT Kanpur (one of the 15 boys out of 800)
- **Others**
  - **Poetry**: Composition in English and Hindi languages
  - **Photography:** Nature Photography and photo editing
  - **Trekking**: Successfully trekked to the summit of Kedarkantha mountain (altitude 12,506 ft), Uttarakhand, India (Mar' 17)

Test Scores

- **GRE** – Total – 326/340, Verbal – 156/170, Quantitative – 170/170, Analytical Writing – 4.0/6.0
- **TOEFL** – Total – 114/120, Reading – 30/30, Listening – 30/30, Writing – 29/30, Speaking – 25/30