# ANIRUDH KULKARNI

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## PhD Scholar

## BRIEF BIO

I am a PhD scholar at the Indian Institute of Technology Indore, and I am currently a research scholar at the Centre for Fluid Dynamics, IIT Indore. I have a strong understanding of Fluid Mechanics, Heat Transfer and Computational Fluid Dynamics. I am adept at OpenFOAM and Parallel Computing with it. Also, I have proof of expertise in both, technical and creative writing.

## EDUCATION

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| 2015 - 19 | Doctor of Philosophy<br>Score - 7.95 CGPA in 21 credits coursework. Thesis submitted on April 14, 2020. | Indian Institute of Technology Indore, India. |
| 2009 - 13 | Bachelors in Engineering<br>Mechanical Engineering.<br>Score - 68.34 %. Note: I have joined PhD directly after Bachelors. | Walchand Institute of Technology, India. |
| 2007 - 09 | Sec. and Higher Sec. School<br>Score - 80.33 % and 80.76 %. | State Board of Maharashtra. |

## PHD THESIS (2020)

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| Title | Numerical Analysis of Performance Enhancement of a Flat-Plate Solar Collector using Porous Media Insertion. |
| Host Institution | Indian Institute of Technology Indore, India. |
| Supervisor | Dr. Shanmugam Dhinakaran, Associate Professor. |
| Details | The thesis focusses on the applications of porous media theory using the open-source CFD tool, OpenFOAM. The problems covered in the thesis diverge in a perspective, while they merge in other. The first two chapters cover simple yet not so obvious porous bluff body studies. Many important and fundamental questions were raised through these studies and one of that was adhered to - What happens if the porous medium is inserted in a channel instead of placing it centrally or close to any of the walls? This syphoned the focus on the performance improvement of a flat plate solar collector channel through the usage of the porous medium. Several different ways are suggested. The thesis aims to inform readers on the modification of generic OpenFOAM codes, and to provide impetus to further development in both, OpenFOAM repository and solar collector performance studies. |

## EXPERIENCE

2015 - 20 **Teaching Assistant** — Indian Institute of Technology Indore, India.

Subjects tutored: Computational Fluid Dynamics, Bio-Fluid Mechanics, Engineering Drawing, Basic Manufacturing Techniques, and Basic Mechanical Engineering.

2014 - 15 **Research Internship** — Indian Institute of Technology Indore, India.

Details of the duties performed:

- Literature survey of numerical studies in fluid flow and heat transfer from porous bluff bodies of different shapes.
- Ran simulations for two numerical studies, performed post-processing for both the works and compiled a full-length paper on the first study.

2013 - 14 **CAD-CAE Tutor; Project Consultant** — Soham Technologies, India.

Details of the duties performed:

- Tutoring commercial CAD packages viz. CATIA V5 and Solidworks (including Solidworks Flow Simulation and Motion Manager) and CAE package viz. ANSYS Mulitphysics and ANSYS Workbench.
- Taking up academic as well as industrial sponsored projects related to CAD, CAE and CFD.

2012 - 13 part time **CAD-CAE Tutor; Project Consultant** — Soham Technologies, India.
During the final year of my graduation, I assisted in establishing this startup. Details of the duties are same as above. Later, I went on to continue with this job full-time.

## PUBLICATIONS (7)

### Renewable Energy - OpenFOAM (2)

- Anirudh, K.. and S. Dhinakaran, "Performance improvement of a flat-plate solar collector by inserting intermittent porous blocks." Renewable Energy 145 (2020): 428-441. IF – 5.439
- Anirudh, K.. and S. Dhinakaran, "Numerical study on performance improvement of a flat-plate solar collector filled with porous foam." Renewable Energy 147 (2020): 1704-1717. IF – 5.439

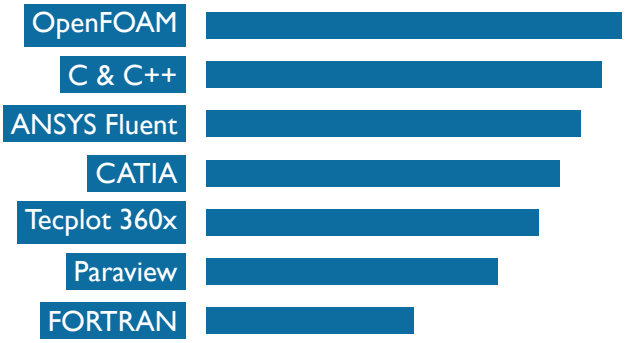
### Porous Bluff Body - OpenFOAM (2)

- Anirudh, K., and S. Dhinakaran. "On the onset of vortex shedding past a two-dimensional porous square cylinder." Journal of Wind Engineering and Industrial Aerodynamics 179 (2018): 200-214. IF – 3.625
- Anirudh, K., and S. Dhinakaran. "Effects of Prandtl number on the forced convection heat transfer from a porous square cylinder." International Journal of Heat and Mass Transfer 126 (2018): 1358-1375. IF – 4.346

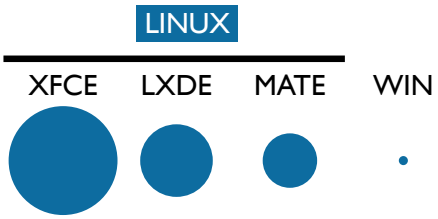
Porous Bluff Body - Lattice Boltzmann Method (3)

- Vijaybabu, T. R., K. Anirudh, and S. Dhinakaran. "LBM simulation of unsteady flow and heat transfer from a diamond-shaped porous cylinder." International Journal of Heat and Mass Transfer 120 (2018): 267-283. IF – 4.346
- Vijaybabu, T. R., K. Anirudh, and S. Dhinakaran. "Lattice Boltzmann simulations of flow and heat transfer from a permeable triangular cylinder under the influence of aiding buoyancy." International Journal of Heat and Mass Transfer 117 (2018): 799-817. IF – 4.346
- Vijaybabu, T. R., K. Anirudh, and S. Dhinakaran. "Mixed convective heat transfer from a permeable square cylinder: A lattice Boltzmann analysis." International Journal of Heat and Mass Transfer 115 (2017): 854-870. IF – 4.346

## SOFTWARE/CODING PROFICIENCY




### OS PREFERENCE




## CONFERENCES ATTENDED/POSTER PRESENTED

1. Anirudh, K., and S. Dhinakaran. "On the shedding of vortices from a porous bluff body." International conference on recent trends in engineering and material sciences (ICEMS - 2016), March 17-19, 2016, Jaipur National University, Jaipur, India. (poster)
2. Anirudh, K., and S. Dhinakaran. "Effects of flow of different coolants on heat transfer from a porous bluff body." International conference on recent trends in engineering and material sciences (ICEMS - 2016), March 17-19, 2016, Jaipur National University, Jaipur, India. (oral)
3. Anirudh, K., and S. Dhinakaran. "Transport phenomena in porous media and its biomedical applications." 5th Industry-Academia conclave IIT Indore - 2017, Sept 06 - 2017, IIT Indore, Indore, India. (poster)

## WORKSHOPS/SEMINAR ASSISTED

1. GIAN course on "Lattice Boltzmann Methods for Multiphase and Multicomponent flows" by Prof. Abdulmajeed A. Mohamad (University of Calgary, Canada) during August 5 - 16, 2019 at IIT Indore.
2. GIAN course on "Advanced Combustion Modelling with Computational Fluid Dynamics" by Prof. Weeratunge Malalasekera (Loughborough University, U.K.) during April 8 - 12, 2019 at IIT Indore.
3. GIAN course on "Energy, Education and Innovation" by Prof. Yunus A. Çengel (University of Nevada, USA) during March 12 - 16, 2018 at IIT Indore.
4. A talk on "Flow visualization as a tool for design of fast breeder reactor" by Prof. P. K. Panigrahi (IIT Kanpur, India) on January 12, 2018 at IIT Indore. (only attended)
5. GIAN course on "Advances and opportunities in passive micro and miniature technologies for energy and thermal systems" by Prof. Amir Faghri (University of Connecticut, USA.) during January 9 - 13, 2017 at IIT Indore.
6. GIAN course on "An Advanced Introduction to the Finite Volume Methods in Computational Fluid Dynamics (with OpenFoam)" by Prof. Marwan Darwish (American University of Beirut, Lebanon.) during September 5 - 9, 2016 at IIT Indore.
7. GIAN course on "Biomathematics: from gene expression to bone mechanics" by Prof. Alexey Zaikin (University College London, United Kingdom.) during August 15 - 28, 2016 at IIT Indore. (only attended)

## BACHELORS' THESIS/PROJECT (2013)

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| Title 1 | Selection of Proper Aerofoil section for the Spoilers, Rear and Front Wings of an FSAE vehicle. |
| Host Institution | Walchand Institute of Technology, Solapur, India. |
| Supervisor | Mr. V. D. Sathe, Associate Professor. |
| Details | In this project, an exclusive study was conducted to select suitable aerofoil amongst the 2500+ aerofoil sections from the UIUC (University of Illinois at Urbana - Champaign) database. For this purpose, we used the student version of the sophisticated tool available for aerofoil selection, 'Profili 2'. |
| Title 2 | Design and Analysis of Downforce Enhancing and Drag Reducing Equipments of an FSAE Vehicle. |
| Host Institution | Walchand Institute of Technology, Solapur, India. |
| Supervisor | Mr. V. D. Sathe, Associate Professor. |
| Details | The various downforce enhancing and drag reducing equipments were critically studied. Selection of proper equipment depends on the operating conditions of the race car and primarily on the flow regime the car is going to operate into. From the selected aerofoil section, front and rear wings were designed and analysed for the decision of number of elements to be used for the wings. Further, other equipments were designed and analysed accordingly, namely: Spoiler, Side pods, Intake, Barge Boards, Splitter and Airdam. Well-flourished commercial softwares viz., Solidworks Flow Simulation and ANSYS Fluent were used and post-processing was performed using their respective generic tools. |

## CONSULTING @ IIT INDORE (2016 - 17)

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| Project 1 | CFD analysis of Flow through a Valve. |
| Details | This project was Industry Sponsered (Jash Engineering Ltd., Indore.) and it was an attempt to validate numerically an experimentally realised valve design, by presenting primary flow characteristics like velocity distribution throughout pipe, pressure drop across the valve, flow coefficient, etc. |
| Role | Modelling the problem and simulating the flow to provide details on flow contours, pressure and velocity distribution, vorticity, turbulence and cavitation. Validating numerical with experimental results of the valve prototype being studied. |

## CONSULTING @ SOHUM TECH. (2012 - 14)

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| Project 1 | Press Fit Analysis of Camshaft and End Bearing for Medium Duty Automobile. |
| Details | This project was Industry Sponsored (Precision Camshafts Ltd., Solapur.). During the installation of camshaft on automobile, the camshaft needs to be press fitted onto support bearings. Hence, the design of end collars of the camshaft becomes crucial, as it should sustain high local stresses. In this project, the contact analyses of the ends were performed to analyse the design of current collars of the camshaft. |
| Role | Modelling the problem and contact analysis of the end bearings and collars of the camshaft. |
| Project 2 | Contact Analysis for Comparison of LM with Flat Guideways for Wearing after 100 Working Cycles. |
| Details | This project was Industry Sponsored (Precision Camshafts Ltd., Solapur.). The regular flat guideways employed on heavy duty machines seem to wear out early and hence, they need to be grounded regularly which reduces their life cycles. The project comprised of comparison between previously employed flat guideways and its replacement linear motion guideways. During comparison, contact analyses were performed along with numerical validation to ensure the replacement is valid. |
| Role | Modelling the problem, contact analysis of the guideblocks and guideways and numerical calculations with convergence study. |
| Project - 3 | Design and Analysis of Supporting Structures/Mechanism for Lifting the Upper Warp Beam of Jacquard Terry Towel Power Loom |
| Details | This project was Industry Sponsored (Dhayfule Textiles Ltd., Solapur.). The regular Upper Warp Beam of Jacquard Terry Towel Power Loom needs to be loaded after each cycle with fresh yarn for the next cycle. The loading and unloading of the warp beam was previously performed manually. In this project, a suitable lifting mechanism was designed to reduce the time loss and man power incurred during the loading - unloading of the beam. |
| Role | Modeling the problem, designing an alternative mechanism, static analysis of the supporting beams, selection of the chain block assembly, selection of eye - bolts, and physical testing along with numerical support. |

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| Project - 4 | Design, Analysis and Simulation of Vertical Carousel Assembly for Carrying Files |
| Details | This project was Industry Sponsored (Dhayfule Textiles Ltd., Solapur.) and the project dealt with providing the company, which also manufactures vertical carousels for maintaining files, with an efficient alternative mechanism for running the carousel. |
| Role | Modelling the problem, designing an alternative mechanism, static analysis of the trays carrying files and simulation of the whole assembly comprising more than 250 parts |
| Project - 5 | Design and Simulation of Steering Controlled Headlight System |
| Details | This project was Academic (Walchand Institute of Technology, Solapur.) and the project was concerned with coupling of the headlights with steering. |
| Role | Modelling the problem, designing an alternative mechanism and simulating the whole assembly comprising more than 200 parts |
| Project - 6 | Design and Analysis of Mixed Refrigerants Joule - Thomson (J - T) Cryocooler |
| Details | This was an advanced research project in cryogenics for Walchand Institute of Technology, Solapur. It has been recognized by IIT Bombay and has won Aavishkar National Level Project Competition. It deals with design and analysis of an intricate cryocooler using mixed refrigerants. |
| Role | Modeling the problem and simulating simple flow and mixing of refrigerants throughout the J - T Cryocooler. The apparatus included typical tube in tube type recuperative. The mixing and separation of refrigerants was key aspect of the project |
| Project - 7 | Application of Centrifugal Pump in Series and Parallel Test Rig along with Modelling and Flow Analysis |
| Details | This project was Academic (Walchand Institute of Technology, Solapur.) and it was an attempt to validate both numerically and physically the rise in pressure head and discharge during the different arrangements of pumps viz. series and parallel. |
| Role | Modelling the problem and simulating the flow, in both the series and parallel arrangements of the pump. The pressure head and discharge rise in the different arrangements of the pump were validated in the SolidWorks Flow Simulation package. |

## ACHIEVEMENTS

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| 2018 | Two research papers published in 2018 were highlighted in the September 2018 edition of nextCFD.com, a reputed periodical which deals exclusively with the field of Computational Fluid Dynamics (CFD).<br>"1. On the onset of vortex shedding past a two-dimensional porous square cylinder."<br>"2. Effects of Prandtl number on the forced convection heat transfer from a porous square cylinder." |
| 2017 | Winner of Ransese - Best Blog competition conducted by Literary Club, IIT Indore. |
| 2016 | An article on parenting featured in the reputed online forum - fatherly.com. "How My Father used 'Gulliver's Travels' and $1.50 to Teach Me About Honesty" |
| 2015 - 19 | Received 'Teaching Assistantship' fellowship from Ministry of Human Resource Development (MHRD). |

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| 2014 | Was offered direct admission to PhD programme at Indian Institute of Technology, Indore after Bachelors. |
| 2013 | Recognition for providing free self-prepared pedagogic presentations on CAD/CAM and series of video tutorials on Catia V5 for Career Counseling Cell during final year of graduation. |
| 2009 - 13 | Received prestigious scholarship from Foundation for Excellence of Rs. 30,000 per year for a period of four years, which provides funds for higher education to students in India who are academically gifted and from very low-income families. |
| 2008 | Stood first in the pre-graduation written examination at Sangmeshwar College, Solapur. |
| 2007 | Received 'Best Outgoing Student Award' at Shri English Medium School, Solapur. |

## MISCELLANEOUS

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| 2016 - 18 | Narrated 'Short Stories' in various sessions held by literary assembly, Srijan at IIT Indore. |
| 2016 | After a year of persistence, founded Chess Club - 'The Berserkers' at IIT Indore. Been the captain of winning team of the IIT vs IIM tournament in Indore. Been the Intra-IIT chess champion the same year. |
| 2014 - 16 | Made regular visits to Old-age homes and Orphanages in collaboration with IIT's NGO – Avana. |
| 2009 - 13 | Active member of Mechanical Engineering Student Association (MESA) and anchored several programs throughout the graduation. |
| 2010 | Member of Winning team for Debate and Elocution Competition 2010, Walchand Institute of Technology Solapur. |

## LANGUAGES (4)

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| Kannada | Proficient | Mother Tongue |
| English | Proficient | First Language |
| Marathi | Proficient | Native Language |
| Hindi | Proficient | Second Language |

## HOBBIES

On my spare time, I read about developments in CFD, explore different Linux distributions, and fiddle with typesetting in LaTeX (This CV is an example).

## PERSONAL DETAILS

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| Nationality | Indian | The land of Gandhi. |
| Marital Status | Married | Wife is preparing for joining PhD. |
| Gender | Male | Sincerely Feminist. |
| D. O. B. | 30 April 1991 | Born in Bengaluru, India. Brought up in Solapur, India. |