VISHAL SUBRAMANIAN

Room No. 422, Jamuna Hostel, IIT Madras, Chennai – 600036, India
vishal-subbu.github.io vishalsubbu97@gmail.com vishal-subbu +91 9597507678

Research Interests

- Integrated Computational Materials Engg.
- Multiscale Modelling of Materials
- Phase-Field Modelling
- High Performance Computing
- Additive Manufacturing
- Computational Fluid Dynamics

Education

Dual Degree (B. Tech + M. Tech) (2014 – 2019)

- Department of Metallurgical and Materials Engineering, Indian Institute of Technology Madras, Chennai, India
- Minor : Foundations of Physics
- CGPA: 9.26/10 (Dept. Rank : 1)

Scholastic Achievements

- Awarded Institute Merit Prize for the **best academic performance** in 4^{th} year of the Dual Degree programme (2019)
- Secured **AIR 58** in Graduate Aptitude Test in Engineering (GATE) (**98th Percentile**) (2018)
- Recipient of **Ministry of Steel Scholarship** for securing $\mathbf{1^{st}}$ **rank** till 6^{th} semester of the Dual Degree programme (2017)
- Awarded Sri Satish Pai Prize for the **best academic performance** in 2^{nd} year of the Dual Degree programme (2017)
- Secured **AIR 3836** in IIT-JEE (Advanced) (**97th Percentile**) (2014)
- Selected for **INSPIRE Fellowship** for being among the **top 1%** in All India Senior School Certificate Examination (2014)
- Received a **merit certificate** for being among the **top 0.1%** in All India Secondary School Examination (2012)

Conference Presentations

- **Vishal S.**, Gandham Phanikumar, *Simulation of deep penetration welding using OpenCL on GPU*, NMD - ATM, Kolkata, 14 - 16 November 2018 - Poster Presentation.
- Abhik Choudhury, **Vishal S.**, Gandham Phanikumar, Shyamprasad Karagadde, Abhishek G.S., *Prediction of microstructure and cracking susceptibility during additive manufacturing: State of the art and challenges*, NMD - ATM, Goa, 11 - 14 November 2017 - Oral Presentation.

Research Experience

Modelling of solidification cracking in laser based additive manufacturing
Advisors: Prof. Gandham Phanikumar and Dr. Abhik Choudhury Aug 2018 - Ongoing

- **Developing codes in OpenFOAM** to model the heat transfer during additive manufacturing process
- **Calculating the residual stress** in the domain to predict the cracking susceptibility

Simulation of deep penetration welding using OpenCL on GPU
Advisor: Prof. Gandham Phanikumar Jan 2018 - Apr 2018

- Implemented **double enthalpy model** to model the solid-liquid and liquid-vapour interactions
- Keyhole morphology was modelled for different radii and velocities
- Included **OpenCL kernels** to parallelise subroutines to eliminate bottlenecks and achieved a gain of 10x

Hot cracking susceptibility of Ni-base superalloys during laser based additive manufacturing
Advisors: Prof. Gandham Phanikumar and Dr. Abhik Choudhury Dec 2016 - Jan 2018

- Performed macro scale simulation using CFD to **predict the thermal profiles and weld pool geometry**
- Observed the **microstructural evolution** under equilibrium and non equilibrium conditions using **Phase Field simulations** for the conditions experienced during the macro scale simulations
- **Quantified the cracking susceptibility** based on the dendritic morphology and ease of fluid flow in the mushy zone

Study on densification and grain growth characteristics during spark plasma sintering of MgO
Advisor: Prof. B S Murty June 2015 - July 2015

- Performed spark plasma sintering of nano MgO powders under various temperature, pressures and currents.
- **Calculated the grain size and porosity** after sintering using X-ray diffraction, SEM and density measurements.
- **Optimised the sintering conditions** to achieve densification without grain growth

Flow in a channel with an obstacle
Course : Foundations of CFD Jan 2017 - Apr 2017

- Developed codes in C++ to model the **flow of liquid in a channel over an obstacle**
- Implemented **SIMPLE algorithm with gauss-siedel solver** to solve for the velocity profile
- Performed post processing and visualization in MATLAB

Calculation of Interfacial energies for θ' precipitates in Al-Cu matrix
Course : Atomistic Modelling of Materials Aug 2017 - Nov 2017

- Proposed methodology to calculate the interfacial energy between a precipitate and the matrix
- Created supercell to calculate interfacial energy which is a useful input for Phase field modelling

Industrial Internships

Phase field modelling of microstructural evolution
John Deere, India May 2018 - July 2018

- Implemented **Multi Phase Field Model** in FORTRAN and coupled it with Abaqus to solve the elasticity equations
- Solved for the composition evolution as well to model γ **to** α **and eutectic transformations** in steels.
- Compared the morphology of the microstructure obtained with experimental micrographs for various process parameters.

Enhancing the hardness of 22 kt gold
TITAN Industries, India May 2016 - July 2016

- **Synthesised different alloy systems** to increase the hardness without compromising purity and aesthetics
- **Achieved twice the hardness** improving its durability

Technical Projects

Waterfall Graphic Print in *Envisage*[1] *(Shaastra*[2] *)* Aug 2015 - Jan 2016

- Fabricated a device which forms beautiful patterns by controlling the flow of falling water
- Programmed an Arduino Uno to control solenoid valves based on an input image
- Won the **most innovative project** award - CFI[3] awards 2016

Augmented Reality App in *Computer Vision* Jan 2015 - Apr 2015

- Developed codes to superimpose a no-smoking sign on an image
- Experimented with various object detection algorithms and OpenCV functions to accurately superimpose the intended image on the input image

Workshops

- Attended DAE-BRNS workshop on **Laser Additive Manufacturing & Allied Technologies (LAMAT)** in Raja Ramanna Centre for Advanced Technology (RRCAT), Indore, India, 8-12 October 2018.
  - Attended lectures on various topics ranging from laser physics to modelling of AM processes.
  - Performed experiments on lasers, Powder Bed process, Direct Energy Deposition process to understand its mechanism
- Attended **ICME Approaches to Innovation in Biomedical Implants** in Indian Institute of Science (IISc), Bengaluru, India, 10-12 August 2018.
  - Introduced to various computational tools like Machine learning, Phase field modelling, Molecular dynamics and its relevance to bio-materials design.

Teaching Experience

Computational Materials Engg. Lab Aug 2018- Nov 2018

- Assisted in teaching undergraduate students the basics of MATLAB programming and modelling
- Designed tutorials and clarified doubts as the students attempted various problems

Computational Skills

- **Languages** : C/C++, Fortran, Python, MATLAB
- **Parallel Computing** : OpenMP, Open MPI, OpenCL
- **Simulations** : Quantum ESPRESSO, OpenFOAM, Abaqus
- **Miscellaneous** : Arduino, Origin, X'Pert HighScore
- **Image Processing** : OpenCV, ImageJ
- **Visualization** : ParaView, VESTA , Gnuplot
- **Thermodynamics** : Thermo-Calc

Relevant Course Work

Computational Modelling
- Atomisitc Modelling of Materials
- Foundations of CFD
- Computational Materials Thermodynamics
- Computational Materials Engg. Lab
- Analysis and Interpretation of Biological Data

Mathematics and Physics
- Mathematical Methods for Chemical Engg.
- Differential Equations
- Quantum Physics
- Classical Physics
- Calculus I,II
- Probability, Statistics and Stochastic Processes

Materials Science
- Mechanical Metallurgy
- Stability of Microstructures
- Solidification Phenomena
- Micromechanics
- Polymers and Colloids
- Electronic Materials, Devices and Fabrication

Other Course Work

- Programming, data structures and algorithms using Python by Prof. Madhavan Mukund (NPTEL[4]) Aug 2018 - Sep 2018
- Machine Learning by Stanford University on Coursera. May 2018 - July 2018
- Phase Field Modelling for Microstructural Evolution by Prof. Peter W. Voorhees (GIAN[5]) March 2018

[1] India's largest student organized techno-cultural show
[2] ISO certified Annual Technical Fest of IIT Madras
[3] Centre For Innovation (CFI) is a forum for student innovation at IIT Madras
[4] National Programme on Technology Enhanced Learning (https://nptel.ac.in)
[5] Global Initiative of Academic Networks (http://www.gian.iitkgp.ac.in)

Positions of Responsibility

Core - Events, Amalgam[6] 2018 Jan 2018 - Apr 2018

- Introduced new events like coding, writing, and quizzing and revamped the structure of Amalgam
- Handled the logistics and requirements of events by coordinating with other teams

Deputy Placement Coordinator - Institute Placement Team 2015 Jan 2015 - Apr 2015

- Managed the logistics during the placement session for about 1200 aspirants
- Contributed to the department placement portal by uploading preparation material on a timely basis

Extra/Co-Curricular Activities

- Won **Wodehouse-Agatha-Asimov Award 2018** for fiction writing under "**Humour**" category
- Organised **Brahm Prakash quiz**[7] as a student volunteer in IIT Madras in association with Indian Institute of Metals 2017
- Won **Ultimate Metallurgist**, **Group Discussion** and **Process Planning** events in Amalgam[6] 2016
- **Star Volunteer** of the project "Computer literacy for all" under the **National Service Scheme**[8] for the year 2014-2015
- Performed on stage for **Envisage**[1]**, Shaastra**[2] **2015** as a part of **Envisage Choreo Team**
- **Rajya Puraskar awardee**, the second highest stage of advancement of a Scout, in **Bharat Scouts and Guides**[9]

References

Prof. Gandham Phanikumar

Department of Metallurgical and Materials Engineering, Indian Institute of Technology Madras

Email : gphani@iitm.ac.in

Dr. Abhik Choudhury

Department of Materials Engineering, Indian Institute of Science

Email : abhiknc@iisc.ac.in

[6] Annual symposium conducted by the Dept. of Metallurgical and Materials Engg., IITM

[7] Brahm Prakash Memorial Metal and Materials quiz

[8] NSS, IIT Madras chapter under Govt. of India

[9] A voluntary, non-political, educational movement (www.bsgindia.org)