

ANSHUMAN SINHA

CONTACT INFORMATION

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EDUCATION

Georgia Institute of Technology, Atlanta
MS CSE, College of Computing
CGPA: **4.0/4.0** (Recipient: Academic Scholarship year 2022-23)

Jul'22-May'24

Indian Institute of Technology Kanpur, India
BT-MT Dual Degree (Thesis in Computations), Materials Science and Engineering
CGPA: **9.0/10** (MT); **8.0/10** (BT) (Proficiency Gold medal and Thesis Gold medal 2nd place)

Jul'15-May'20

St. Michael's High School, Patna, Bihar, India *AISSCE, CBSE Board*

Grade 12: Percentage Score: **94.6%**

May'14

Grade 10: Percentage Score: **95.0%** , CGPA: **10/10**

May'12

RESEARCH INTEREST

Primarily interested in developing Machine learning architectures with Physics based priors. Deep Learning architecture development, Graph based Machine Learning, Network modelling. Work involving ML in the field of science, in order to solve non-linear systems such as disease evolution, weather prediction, social network.

ACHIEVEMENTS

- Awarded the '**Institute Proficiency medal**' for the Best project among the graduating students at the Institute's Convocation Ceremony of IIT Kanpur for the year 2020.
- 2nd position for the '**Prof. Baldeva Upadhyay Gold medal 2020**' for the Best M.tech thesis at the Institute's Convocation Ceremony of IIT Kanpur, 2020
- Nominated for IIM, **AK Bose Gold Medal 2021 (National Award)** for the best student overall in Materials Engineering in India. (To be decided on 14th Nov 2021)
- Incubated my own **startup Medrev and STEMrev Refineries** to solve the acute medical challenges being faced by my country during the Pandemic in 2020.
- Ranked 1st among the students in BT-MT & MT batch of 40 students (IIT Kanpur).
- Awarded **Institute scholarship** (Georgia Institute of Technology); Full tuition waiver and GTA position at Georgia Tech for MS 2022-24
- Awarded **Institute Steel Scholarship** based on CPI and project in the area of iron and steel for the year 2018' , 2019'.
- Secured an International **Rank of 103** in the **International Mathematics Olympiad 2012** with a participation of 14 Countries. Final round in **RMO** Regional Maths Olympiad 2014.
- Ranked among the top **0.2%** of **1.5 million** candidates in the Joint Entrance Examination for admission into IITs (IIT-JEE 2015).

CONFERENCES

- Poster presentation in **TMS ICME 2021** on the topic "Vertical Integration of Models to Minimize Ladle Processing Time", to be held on 24-28 April, 2022, Nevada, USA.
- Presented in the **CCC Annual Meeting**, 11th August. Computational material science; Title: Nitride precipitate formation in CC steel using a cluster-model, Colorado, Denver, USA.
- **Best Poster Award** at Research Scholar Day 2020 IIT Kanpur, Title: 'Integrated Multi-Physics Model for determining LF Processing time'
- Presented on "Non-linear optimisation of Ladle refining process" at APM 2019 (Advances in Process Metallurgy) held on 4th-5th July, 2019 at IISc Bangalore, India.
- Selected for Oral Presentation in "**11th International Conference on Molten Slag, Fluxes and Salts**" to be held on 21st-25th Feb, 2021 at Seoul, South Korea.

WORK EXPERIENCE

Machine learning and CSE:

Research project: Deep learning, CSE Georgia Tech. [link](#)

Advisor: Prof. Spencer Bryngelson

Jul'22-Present

- Developing Deep learning architecture for mathematical operator estimations, in order to compute highly-oscillatory integrals at sub-grid scale for Phase-averaged bubbly flow model.
- The network architecture is build with the help of scientific machine learning library called 'deepxde' with Tensorflow backend.

ML Project: Inter regional relations between Disease outbreak and search trends [link](#)

- Prediction of disease outbreak through ML models (like LSTM and GRU) with the help of top k-search trends. Top k most correlated time-series calculated in embedding space.
- Estimation of virality on population graph using meta-data based on contacts with the help of optimised infection transfer variables and of SIR-Network (graph) model.

ML Researcher, Georgia Tech, Atlanta, USA. [link](#)

May'21-Jul'22

- Developed a Graph transformer network (GTN) for heterogeneous graphs used in representation learning tasks such as node classification and link prediction on TensorFlow.
- It is an adaptation to the original Pytorch model with the help of Tensorflow functional API.
- The work involves modelling of Graph Transformer Networks (GTNs) that are capable of generating new graph structures, which involves identifying useful connections between unconnected nodes on the original graph, while learning effective node representation on the new graphs in an end-to-end fashion.

Computational Engineering & Material Science:

Research Assistant, Mechanical Engineering Department, Colorado School of Mines, Denver, USA, Advisor: Prof. Brian G Thomas

Feb'21-Present

- Developing a numerical kinetic precipitation model to predict evolution of precipitate size distribution, with the help of mathematical grouping techniques.

CTO, Co-founder, STEMrev Refineries, SIIC IIT Kanpur, INDIA,

Sep'20- Present

- **MEDrev** — Medical and Personal Care devices like health monitoring and ventilation systems: Focused on bringing the much-needed engineering expertise in this field with the help of **Artificial intelligence**.

Research Engineer, Materials Science and Engineering Department, IIT Kanpur, Advisor: Prof. Amarendra Kumar Singh

Jul'18-Feb'21

- Head CFD Engineer in model based optimization tool for enhancing energy efficiency, productivity, and yield of Electric Arc Furnaces (EAF-OPT).

PUBLICATION

Deep learning architecture of flop-efficient numerical integrator.

Anshuman Sinha, Ethan Pickering, Spencer Bryngelson. (Draft currently under-process) [link](#)

- Finding answers to the question 'Can a multi-layer perceptron Neural Network serve as flop-efficient numerical integrator'.
- Developing Deep learning architecture for mathematical operator estimations, in order to compute highly-oscillatory integrals at sub-grid scale for Phase-averaged bubbly flow model.
- The network architecture is build with the help of scientific machine learning library called 'deepxde' with Tensorflow backend.

Computational study of non isothermal slag eye formation and its effects on ladle refining

Anshuman Sinha, Amarendra Kumar Singh. (Metallurgical and Materials Transactions B), 2021, (Submitted) [link: Publication1](#)

- A computational study of the slag-eye opening and the fluid-flow condition pertaining to this opening is performed with the help of mathematical modelling implemented in a numerical architecture.
- The bubble plume is modelled with the help of Discrete Phase modelling (DPM) coupled with Discrete random walk model for including the particle level turbulence.
- A theoretical standpoint is given for the behaviour of slag eye in the actual steel ladle, and possible effects of non-isothermal conditions on flow characteristics is analysed in the view of ladle refining

Optimisation of a Deep-learning based multi surrogate model system with the help of Genetic algorithm.

Anshuman Sinha, A K Singh. (Draft only, paper under peer-review) [link: Publication 2](#)

- The work looks at the optimisation of the ladle furnace operation and explores ways and means of reducing the LF processing time with the help of multi surrogate models.
- With the help of previously developed full-scale CFD Solver, we have created a Deep learning based surrogate model of physical system, which takes low time to predict the ladle desulphurisation behaviour.
- The ANN surrogate model acts as input to the constructed non-linear Objective function which is then optimised using a genetic based algorithm such that an optimal solution for the ladle process variable is obtained.

Dynamics of slag-metal reactions during the ladle refining process

Anshuman Sinha, Amarendra Kumar Singh. [MOLTEN 2020], The 11th Molten Slags, Fluxes and Salts [link: Publication 3](#)

- The work investigated the impact of evolving slag and metal chemistry during ladle refining on the process of desulfurisation.
- In this work, we investigated the slag-metal reactions as a reacting flow problem between two fluids under the action of an agitating inert gas with the help of computational fluid dynamics.

Computational study of flow field and associated slag-metal reaction in a gas stirred ladle

Anshuman Sinha [Master's Thesis], IIT kanpur [link: Publication 4](#)

- A transient 2-dimensional model of ladle furnace was developed based on multi-scale modelling perspective, with different models communicating results of different scales
- The Chemical reactions taking place in the inter-facial region of slag and metal was modelled as mass transfer problem with 'small eddy theory' and implemented through custom made code in the solver.

RELEVANT COURSES

Courses: Machine Learning, Probability & Statistics, Advanced Linear Algebra, Deep Learning and Neural Networks Theory and Applications, Data science in epidemiology, Computational Fluid Dynamics, Graph-ML, Computational Turbulence, Optimisation in Machine learning, Computational Methods in Engineering

TECHNICAL SKILLS

Languages: C, C++, Python.

ML Platforms: Tensorflow, Pytorch.

Libraries: Sci-kit learn, Networkx, Pandas, Numpy.

Software/Tools: Fluent, ANSYS Structural, ANSYS Thermal, MATLAB, Aspen Plus, COMSOL Multiphysics, LaTeX, HTML.