Utkarsh **Thakre**

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Publications

2020 Utkarsh Thakre and Asim Tewari. **"Using Automated Finite Element Framework to Analyze Offshore Grid Turbine Blades Design"** Fluid Mechanics and Fluid Power 2019, 978-981-16, 490975-1-En, (Chapter 68)

2021 Utkarsh Thakre and Asim Tewari, **"Effect of Residual stresses Evolution in Resin Transfer Molding curing process on Fatigue Life of Glass Fiber composites"** Composites : Part B, 2021 (Under peer-review)

2021 Utkarsh Thakre and Rakesh Mote,**"Stochastic Finite Element Analysis of Selective Laser Sintering process using Polynomial Chaos based Response surfaces"**, Applied Soft Computing, 2021 (Under Review)

Masters' Project

July '21- June '22 | **Residual Stresses analysis in Directed Energy Deposition(DED) -substractive manufacturing** | **Prof. Asim Tewari**

- Formulation to model for residual stresses evolution in DED process**without** meltpool **flow complexities**
- Multi-physics coupling with **laser matter interaction, evolving material model and Solidification kinetics**
- Obtain optimal range of values of **Laser power, source velocity and feed rate** to minimize residual stresses
- Experimentation and validation on a novel **state-of-art 5 axis** high-precision Laser Additive-substractive facility

Research Experience

Dec '18- Dec '20 | **Multi-physics Automated Finite Element Framework in Python** | **Guide : Prof Asim tewari**

- Formulated an **in-house multi-physics** analysis framework using Automated Finite Element libraries in python
- Major Analysis : **Thermo-mechanical, Transient Structural, Visco-elasticity, Plasticity**, Phase-field Models

June '20- Present | **Modeling of Laser based powder-bed sintering Processes** | **Guide : Prof. Rakesh Mote**

- Used **in-house codes** to model coupled laser-powder interaction and heat transfer phenomenon in the melt pool
- Analysed **Uncertain process parameter** effect on Sintering, porosity, melt zone dimension, & process efficiency
- Numerical model formulation to predict hardness and micro-structure based on the thermal solutions

Nov '19 Present | **Micro-mechanical analysis of Composites Molding and Curing Process** | **Guide : Prof. Asim Tewari**

- Residual stress analysis with coupled physics model involving **cure kinetics, heat-transfer** & **visco-elasticity**
- Performed parametric analysis to study effects of **CTE, Cure shrinkage, fiber volume fraction** on residual stresses

Industrial Exposure And Internships

Jun '20 - Jul '20 | **Non-Intrusive Parametric Uncertainty Analysis** | **Airbus : Trainee (Air-frame Design)**

- Developed a **High fidelity** Stochastic Finite Element framework using Polynomial Chaos Expansion based Method with over **10 times higher efficiency** than traditional Monte Carlo Simulations
- Used **Karhunen Loeve Expansion** for Quantification of Stochasticity due to **Spatially Variable Random Fields**

Dec '18 - Jan '19 | **Dynamic Analysis of Aircraft Slats** | **National Centre for Aerospace Innovation and Research**

- Analysed **composite layups of aircraft slats** for effects of varying laminate, layup, draping and matrix conditions
- Performed rigorous analysis under **Static, Modal, Transient, Random and Explicit Dynamic analysis** settings

Aug '19 | **Spray Header Cooling System Analysis** | **GE Power and National Thermal Power Corporation**

- Secured **a collaborative project** at NCAIR for Thermo-Mechanical analysis of spray header cooling assembly
- Modeled Glass fiber composite layups and analysed them under **sustained pressure and static thermal loads**

Honors and Awards

2021 Received **Undergraduate Research Award** for **distinguished research** by the Department of Mechanical Engineering, Indian Institute of Technology Bombay.

2017 Attained All India **99.45 percentile** in **JEE Mains out of 1.2 million candidates**

2015 Received **Certificate of Merit** from CBSE for **outstanding performance** in All India Secondary School Exams

2018 Secured **AP grade** for **Excellence** in MM207 Engineering Metallurgy course in a batch of **over 150 students**

2019 Secured **AP grade** in ME218 Solid Mechanics lab for **outstanding performance** in a batch of **157 students**

2019 Awarded **Certificate of Appreciation** from Head of the Dept. of Mechanical Engineering for notable work during tenure as the Department Newsletter Editor.

2019 Awarded **Certificate of Merit** in National Level cohort of Boeing **Innovation Leadership Development** Program

Education

Degree	University/School	CPI/%	Year
Bachelors & Masters	Indian Institute of Technology, Bombay	9.0/10	2021
Intermediate/+2	Sri Chaitanya Vidhyaniketan, Vishakhapatnam	93/100	2017
Matriculation	St. Mary's School, Balaghat.	10/10	2015

International Exposure| Unmesh Mashruwala Innovation Cell IIT-B

International Rank 1 : IARC Simulation challenge | International Rank 1 : IGVC | Winner : ASME-Student Design Challenge | Best Presentation : IARC msn. 8

Winner of numerous international competitions including ASME-SDC, IGVC, IARC-SC, Unmesh Mashruwala Innovation Cell (UMIC) is a team of dedicated students from pan IIT-Bombay coming together to design and fabricate innovative technologies

Barcelona Smart Drone Challenge | Barcelona, Spain *(2019-2020)*

- **Head of the Mechanical Subsystem** of a dedicated institute level team developing state-of-art autonomous aerial drones
- Performed rigorous aerodynamic analysis to **achieve highly efficient, low drag and maneuverable** fixed wing design

International Aerial Robotics Competition| Beijing, China *(2018-2019)*

- Fabricated **durable, lightweight** propeller guards, designed to be highly aerodynamic with reduced flow induced vibrations
- Manufactured Carbon-fibre reinforced composite frame analysed to optimize for increased **arm loading** & **impact capacity**

Key Academic Projects Undertaken

IIT BOMBAY
2017-21

Course Project Topic	Course	
3 DOF Manipulator for Teleoperated laparoscopy	Collaborative Engineering	*(Spr '21)*
Parallelizing Stochastic Finite Element Methods	High Performance Computing	*(Spr '21)*
High fidelity RBF based Mesh Morphing algorithm	Computer Graphics and modelling	*(Fall '20)*
Growth Analysis of Titanium Nanotubes	Manufacturing processes	*(Fall '20)*
Topology optimization using Genetic Algorithms	Engineering Design Optimization	*(Spr '21)*

Skills

Programming	C++, C, Julia, Python, Matlab, GNU-Octave, Linux bash scripting, HTML
Scientific Computing	Maple, OpenCL, MPI, OpenMP, Pandas, CUDA, Scikit Learn, Tensorflow
Finite Element Analysis	FEniCS (Python Multi-physics FE Library), ABAQUS, ANSYS, COMSOL
Designing and Modelling	AutoCAD, Solidworks, OpenSCAD, GMSH(Meshing), Hypermesh, VTK , Paraview
Robotics Simulation	ADAMS (Machine Design), ROS-Gazebo and ROS-Rwiz (Robotics Simulation

MENTORING AND LEADERSHIP ACTIVITIES

2019 **Boeing BUILD Program :** Part of team of 3, selected (out of 800 teams Pan India) to participate in **National level Cohort** of the Boeing BUILD program and successfully completed the **Leadership Development Workshops**

2018 **All Terrain Service Vehicle** : **Lead a team of 4** to design a multi-terrain bot as a part of Institute level supervised Technical Summer Project. Shortlisted **out of 120+ teams throughout the institute**

2019 **Institute Aeromodelling Competition** Mentored a team of four undergraduates for their Institute Technical Summer Project under Institute Technical Council and **Aeromodelling Club IIT Bombay**

2019 **Institute Technical Summer Project** Mentored and supervised a team of four undergraduates for design of their **amphibious Drone** as a part of the Institute Technical Summer Project under Institute Technical Council IIT Bombay

CERTIFICATIONS

2020 Specialisation in **High-Performance Finite Element Modelling** accredited by **KTH Royal Institute of Technology.**

2021 Secure a score of 102 out of 120 in the TOEFL (Internet-Based Test) conducted by ETS

TEACHING AND POSITION OF RESPONSIBILITY

Jul '21-Present | **Teaching Assistant** | **ME781 Data Mining and statistical Machine Learning**
- Part of group of 10 TAs responsible for Assessments, Grading and Counselling for **over 250 registered students**.
- **Responsible for Mentoring and grading seven student teams** for development of the major final course project.

Jul'18 Jun '19 | **Editor** | **Department Newsletter** | **Dept. of Mechanical Engineering, IIT Bombay**
- Lead a team of **11 editors** to publish the **Autumn 2018 edition** of newsletter with readership of over **500 students**.
- Part of Department committee responsible for organizing **Freshmen orientation and 56th Convocation of IITB.**

2018 2020 | **Manager** | **Unmesh Mashruwala Innovation Cell (UMIC), IIT Bombay**
- Part of the team incharge of **planning, organizing** events and managing **over 250** yearly recruitment applications.
- Showcased key team projects in UG Tech-orientation and **Tech and R&D Expo 2018** with audiance of **over 300**.

EXTRA-CURRICULAR

Sports and Athletics	Attended **Advanced Summer Camp** in Volleyball for Annual **Inter-IIT Sports** Competition.	*(2018)*
	Won **Gold Medal** in **Volleyball** Annual Sports Competition of ST. Mary's School, Balaghat.	*(2014)*
	Gold Medalist in **Tug of war** in Annual Sports Competition of ST. Mary's School, Balaghat.	*(2015)*
	Secured **3rd Rank in** Men's Intra-Institute **Lawn Tennis** open IIT Bombay.	*(2021)*
	Secured **under top 30** position in General Championship Crossy out of **400+ participants**.	*(2019)*
Social and Literature	Secured **2nd Rank** in the General championship for **English creative writing**.	*(2018)*
	Represented hostel to secure **2nd position** for **Hindi poetry** in General Championship.	*(2018)*
	Actively involved in the **'Swacch', a cleaning initiative** by E-cell IIT Bombay	*(2017)*
Interests	• Fiction | Writing | Anime | Drawing | Trekking | Lawn Tennis | Volleyball | Running | Badminton	

REFERENCES

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