Shubhra Kamal Nandi

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Education

Master of Technology *2019 - 2021(exp.)*

Mechanical Engineering (Specialisation: Manufacturing)
Indian Institute of Technology Ropar
CGPA **9.22/10** (*ongoing*)

Bachelor of Technology *2014 - 2018*

Mechanical Engineering
National Institute of Technology Durgapur
CGPA **8.49/10**

Academic Experience

M.Tech Thesis

Development of a Semi-analytical Model for the prediction of temperature distribution and residual stress evolution in Selective Laser Melting *2020 - 2021*

Supervisor: Dr. Anupam Agrawal, *IIT Ropar*

- Adopted analytical solutions for volumetric moving heat source to simulate laser heating.
- Simulated stress distribution using kinematic hardening theory
- Predicted temperature distribution and residual stress at low computational cost.

B.Tech Project

Design and Development of Quarter Car Suspension Test Rig Model *2017 - 2018*

Supervisor: Dr. Nilotpal Bannerjee, *NIT Durgapur*

- Derived objective functions to optimize ride comfort and road holding for a quarter car model.
- Developed a quarter car test rig to conduct experiment and test performance characteristics of passive suspension system.

ROBOCON

Supervisor: Dr. Shibendu Sekhar Roy, *NIT Durgapur* *2016 -2017*

- Conceptualized and prepared a CAD assembly design of a robot that can throw and place discs at variable distances and heights.
- Build-up the semi-autonomous Arduino programmed bot that could follow lines, pan and tilt to accomplish the task.

Auto-Flush

Supervisor: Dr. Shibendu Sekhar Roy, *NIT Durgapur* *2015 - 2016*

Fabricated an inexpensive auto-flushing sanitary system for rural use.

Teaching Assistantship

Machine Drawing (ME202), *IIT Ropar*
Course Instructors: Dr. Navin Kumar, Dr. K. M. Navaneeth
Assisted in lab sessions and helped students to learn the basics of machine component drawing. Graded lab assignments and exams, and assisted students with questions during office hours.

Publication

Nandi, S. K., Kumar, R., Anubhav, Agrawal, A., "Prediction of melt-pool characteristics for Ti6Al4V using semi-analytical model", *Manufacturing Science and Engineering Conference - ASME*, University of Cincinnati, Ohio, USA, June 21-25, 2021

Technical Skills

CAD - CATIA, SolidWorks
FEA - COMSOL
Programming - MATLAB, Python, C++
Workshop - Mechanical and CNC Lathe, Milling Machine; polymer 3D Printer; Hybrid micro-machine DT-110i, SEM & EDS.

Key Courses

Finite Element Analysis · Micro-Manufacturing · Computer Integrated Design and Manufacturing Systems · Linear Algebra · Solidification Processing · Introduction to Plasticity · Theory of Elasticity · Measurements and Instrumentation · Numerical Methods · Deep Learning for physical systems

Vocational Training

Summer trainee for a period of two months(*May-Jun '17*) at the workshop of Indian Oil Corporation Limited, Haldia Refinery.

Responsibilities

Lead the college team in national robotic competition **ROBOCON - 2017**.
Authorized the mess management system of campus hostel Hall IV, *NIT, Durgapur*.
Member of Mechanical Engineering Student Association(**MESA**), *NIT Durgapur*.
Represented club and school in inter- and intra-school activities.

Annexure

M.TECH THESIS

Development of a Semi-analytical Model for the prediction of temperature distribution and residual stress evolution in Selective Laser Melting

Abstract: 3D Printing technology, also referred as "renaissance in manufacturing", has revolutionized the modern manufacturing concept in past few decades with the utilization of electron and laser beam. Selective laser melting(SLM) has gained a lot of importance for being a state-of-the-art manufacturing process capable of building highly customized products of complex geometry in layer-by-layer incremental fashion. Thermal stress due to high thermal gradients, deterioration of surface roughness and fatigue life due to balling effect, undesired porosity due to impurities and low energy absorption are some of the challenges of SLM process. An algorithm comprising of analytical solution for volumetric moving heat source followed by numerical formulations for conduction-convection cooling has been developed to predict the temperature distributions and melt-pool geometry in the part's manufacturing. Fully implicit Finite Volume equations are framed with appropriate part boundary conditions for two-dimensional domain and solved iteratively by Alternating Direction Implicit(ADI) method in MATLAB. The work is then extended to simulate layer-by-layer single-scan deposition and prediction of residual stresses by kinematic hardening theory. Indicative advantages of the model has been identified as:

- Properly defined boundary conditions of the domain along with all dominant process parameters for single hatch melting like laser power, scanning speed, beam diameter, layer thickness, dwell time and base-plate temperature can be studied.
- Phase changes from powder phase to liquid then re-solidification to solid phase has been incorporated in the model by apparent heat capacity method.
- The dynamic nature of the process has been reflected by incorporating the temperature dependent material properties. A decision block in the algorithm to assess the quasi-steady state optimizes the simulation.
- The effects of varying laser parameters for different materials can be investigated extensively at low computational cost and efficient memory usage.

The proposed model has been validated by experimental data from references. Simulations for single-track single-layer and multi-layer part manufacturing has been studied by varying the process parameters.

B.TECH PROJECT

Design and Development of Quarter Car Suspension Test Rig Model

Abstract: The suspension systems carries the total load of the vehicle and provide comfort to passengers by isolating vibrations from road surface transferred to vehicle via tires and there is a need for finding an optimal level of both ride comfort(RC) and road holding(RH) in passive suspension systems. Objective functions to optimize RC and RH with input variables have been derived using modal analysis concept with the help of a quarter car model and sprung and un-sprung mass displacements were calculated in MATLAB. Simulation models of quarter car with and without driver and seats were developed using SIMULINK work-space. A quarter car test rig was developed for execution, analysis and interpretation of theoretical work.