

Amal S Sebastian

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Education

2017–2022 **Master of Technology and Bachelor of Technology**
Indian Institute of Technology Bombay, Aerospace Engineering, GPA – 9.07/10.
Minor in Computer Science and Engineering

Bachelors Thesis

Title *Smoothed Particle Hydrodynamics in Computer Graphics*
Supervisors Professor Prabhu Ramachandran
Description This thesis is an effort to implement and explore algorithms in computer graphics to simulate fluid flows, multiphase flows and rigid body dynamics using the meshless Lagrangian particle based technique of Smoothed Particle Hydrodynamics (SPH).

Publications

Under Review Prabhu Ramachandran, Kunal Puri, Aditya Bhosale, A Dinesh, Abhinav Muta, Pawan Negi, Rahul Govind, Suraj Sanka, Pankaj Pandey, Chandrashekhar Kaushik, Anshuman Kumar, Ananyo Sen, Rohan Kaushik, Mrinalgouda Patil, Deep Tavker, Dileep Menon, Vikas Kurapati, **Amal S Sebastian**, Arkopal Dutt, & Arpit Agarwal. (2019). PySPH: a Python-based framework for smoothed particle hydrodynamics. Preprint: arXiv:1909.04504v2

Research Interests

Particle Methods in CFD, Scientific Computing, Machine Learning

Projects

Research and Technical Projects

- 2020 **Simulation of vortex rings, sloshing tanks, dam break using SPH**
Guide: Prof. Prabhu Ramachandran, Dept. of Aerospace Engineering, IIT Bombay.
- Implemented a Gaussian vortex ring simulation using PySPH. Currently working on simulating collision of vortex rings and verifying accuracy of simulations done so far.
 - Carried out simulations of rectangular sloshing tanks under horizontal and rotational excitations. Compared computed results with experimental data from literature and close agreement between the two was obtained.
 - Carried out simulations of multiple dam break problems with obstacles. Computed results showed good agreement with experimental results.

2019 **PySPH and Mayavi**

Guide: Prof. Prabhu Ramachandran, Dept. of Aerospace Engineering, IIT Bombay.
Worked on improving functionality and adding features to PySPH and Mayavi which are open source Python projects

- Developed code to generate uniform particle distribution and surface particle distribution of a STL object which can be used for SPH simulations in PySPH
- Developed code to visualize STL objects along with their normals and allow for inversion of the normals using mouse interaction for Mayavi a 3D scientific data visualization toolkit
- Modified the Picker structure to display coordinate and data information on the scene using VTK's Text widget. Implemented an onscene slider and button widget for Mayavi

2018-Present **Senior Design Engineer**

RAKSHAK, IIT Bombay.

Part of a student tech team which designs and builds UAVs for search and rescue missions

- Part of the aerodynamics subsystem of the team which mainly deals with the design and manufacturing of the UAV
- Primary work pertains to design of the wing, and estimation of performance characteristics
- Represented RAKSHAK at the Indian National Academy of Engineering's Youth Conclave at IIT Delhi under the Lab to Market category and secured first place in it

2018 **Cyclocopter**

Institute Technical Summer Project, IIT Bombay.

- Attempted to create a VTOL device based on cycloidal blade systems. Designed and manufactured major components of the model and carried out tests of the same.

Course Projects

2020 **Vortex Methods**

Guide: Prof. Prabhu Ramachandran, Dept. of Aerospace Engineering, IIT Bombay.

- Wrote generalized code for 2D vortex methods and simulated flow over a cylinder using panel methods.

2019 **Trajectory Modelling of Long March 3B/Bediou 3M-15**

Guide: Prof. Ashok Joshi, Dept. of Aerospace Engineering, IIT Bombay.

- Designed the complete ascent mission trajectory of the four stages of Long March 3B, by finding the optimal burn profile and the gravity turn at each stage.
- Found out the optimal orbital manoeuvres taken by Bediou 3M-15 to reach final orbit from point of release in actual mission time

2018 **Computation using potential flow theory**

Guide: Prof. Aniruddha Sinha, Dept. of Aerospace Engineering, IIT Bombay.

- Used the concept of stream function to obtain and visualize the streamlines for super-critical circulation of a rotating cylinder in Python by superimposing results of doublet, vortex and uniform flow.

2018 **Data Analysis**

Guide: Prof. Prabhu Ramachandran, Dept. of Aerospace Engineering, IIT Bombay.

- Analyzed how education affects various parameters of society on the basis of the 2001 districtwise Indian Census report using pandas library.
- Correlated the data of literacy rate to various parameters such as sex ratio, number of educational institutions, graduates, workers

Awards, Scholarships and Achievements

- 2019 Inducted as a student member of the Indian National Academy of Engineering
- 2019 Received AP grade for exceptional performance in Vibrations and Structural Dynamics course. (Given only to 1 student out of 90)
- 2017 Secured All India Rank 1572 in JEE Advanced 2017 among 200,000 students.
- 2017 All India Rank 834 in the JEE Mains 2017 taken by over 1.2 million students.
- 2015 Recipient of the prestigious National Talent Search Examination (NTSE) scholarship given by NCERT.

Technical skills

- Languages C, C++, Python, Cython
- Tools XFLR5, Ansys Fluent, SOLIDWORKS, AutoCAD, Git

Coursework

- Graduate Particle Methods for Fluid Flow Simulation, Numerical Methods for Conservation Laws, Hypersonic Flow Theory, Multiscale Modelling of Materials, State Space Methods for Flight Vehicles
- Undergraduate Aerodynamics, Incompressible Fluid Mechanics, Compressible Fluid Mechanics, Introduction to Machine Learning, Data Structures and Algorithms, Design and Analysis of Algorithms, Logic for Computer Science, Data Analysis and Interpretation, Spaceflight Mechanics

Positions of Responsibility

- 2020-2021 Coordinator - Department Academic Mentorship Program, Department of Aerospace Engineering, IIT Bombay
- 2019-2021 Department Academic Mentor