Dasu Deva Karthik Lakshman

+91 950-531-8055 | karthiklakshmandasu@gmail.com | LinkedIn | dev-karthik-lakshman.github.io

Education

Indian Institute of Space Science and Technology (IIST), Thiruvananthapuram *2018 - 2022*

Bachelor of Technology in Aerospace Engineering (AE)
CGPA : 8.75/10
Advisor : Dr. Pankaj Priyadarshi

Selected Research Projects

Vikram Sarabhai Space Centre, ISRO

1. Design of three-phalanxe three finger under-actuated multi-purpose compliant gripper **May 2024 – present**
   - Configured the gripper as a modular, single DoF compliant mechanism towards the goal of global applicability.
   - Synthesized the phalanxes of the fingers using freudenstein's equations by optimizing the transmission defect.
   - Developed a finite element model to computing the gripping forces for various irregular shaped objects.
2. Motion planning of the series-parallel robotic manipulator for 3D printing in space experiment **Dec, 2023 – present**
   - Formulated the forward and inverse kinematics of the series-parallel hybrid robotic manipulator.
   - Formulated the optimal time-jerk motion planning problem as a multi-objective optimization problem using cubic splines. Presented at INSARM'23.
   - Introduced novel radial basis functions for planning minimal jerk trajectories.
3. Feasibility study of the Venus Balloon and Impact probe for the Indian Veuns mission **July, 2024 – Jan, 2025**
   - Modeled the preliminary configuration of the separation and deployment mechanisms of the aeroshell module
   - Developed the preliminary entry flight sequence of the aeroshell module.
   - One of the five selected projects from VSSC, which were presented to the **Secratary, Department of Space, India**.
4. Study of reusable crew seat impact attenuation system for Indian manned space mission **July, 2023 – Sep, 2023**
   - Studied three semi-active configurations: Hydraulic, Hydro-pneumatic and Airbag to replace the passive honeycomb based impact attenuation system.
   - Optimized the attenuation systems with respect to the spatial constraints of the crew module and proposed a control law for each of the system.
   - With the existing spatial constraints, the semi-active hydraulic system is proven to be optimal, reducing the NASA's Brinkley DRI by 36% compared to conventional honeycomb system. Published at **SAE AeroCON 2024**

Indian Institute of Space Science and Technology (IIST)

1. Reliability-based design optimization of novel Spear-In-Sand spent stage recovery approach **June, 2022 – Nov, 2022**
   – *Advisor: Dr. Pankaj Priyadarshi*
   - Optimized the touchdown state vector of the spent stage satisfying the safety chance constraints for required reliable probabilities under uncertainties by formulating as a Reliability-based design optimization (RBDO)
   - Developed a *Modified Sequential Optimization and Reliability Assessment using Monte Carlo simulations (MSORAMCS)* algorithm, which reduced the computational cost by **49%** with less than **1%** error.
2. Multi-disciplinary design optimization of Spear-In-Sand spent stage recovery of launch vehicle **Dec, 2021 – May, 2022**
   – *Advisors: Dr. Pankaj Priyadarshi and Dr. Raveendranath P*
   - Modeled the landing dynamics of penetration of landing legs into the sand using finite element analysis with the touchdown state vector as the input and the penetration, impact forces as the output.
   - Constructed a surrogate model for the finite element analysis using Radial Basis Function Neural Networks (RBFNN) and a second order gradient based adaptive sequential sampling method.
   - Formulated a multi-disciplinary design optimization problem by integrating the re-entry trajectory with the surrogate model, optimizing throttling the parameters and angle of attack with impact forces as the cost function.
3. Multi-disciplinary design optimization of a small size expendable launch vehicle **July, 2021 – Oct, 2021**
   – *Advisor: Dr. Aravind Vaidyanathan*
   - Formulated the 3 DoF trajectory of launch vehicle with all the phases: gravity turn, stage separation, coasting, etc.
   - Formulated the solid rocket motor grain *burn back* analysis with geometric parameters as the design variables.
   - Integrated the sizing, aerodynamics, and propulsion modules to trajectory module using Multi-disciplinary Feasible (MDF) architecture and solved the design problem as an Multi-disciplinary Design Optimization (MDO) problem.

Professional Experience

Vikram Sarabhai Space Centre, ISRO

Space mechanisms scientist, Aerospace Mechanisms Group (ASMG)

1. System design engineer for GAGANYAAN Crew Module Up-righting System (CMUS) **Dec 2023 – present**
   – *Makes the Crew Module mono-stable in the water for safe recovery using inflatable floats.*
   - Developed origami-inspired optimal folding methods for the CMUS inflatable floats and validated the same for the worst case scenario flight loads.
   - Developed the space qualification plan and instrumentation plan for the system.
   - Designed the joint scheme between the crew module and the inflatable floats to withstand the buoyancy loads.
   - Carried out the structural analysis of all components of the system and verified the robustness of the system.

2. System engineer for LVM3 payload fairing for **Chandrayaan-3** and **OneWeb-2** missions **Nov 2022 – July 2023**
   – *Asia's second largest payload fairing.*
   - Carried out space qualification and acceptance testing of payload fairing separation system, shock-reduction system, acoustic protection system, debris-free system, and rain-proofing system.
   - Led a team of five and carried out integration of payload fairing auxiliary systems.
   - Carried out encapsulated assembly with spacecraft and final assembly to the launch vehicle.
   - Carried out post-flight performance analysis of all the payload fairing auxiliary systems.

Publications & Manuscripts

Journal articles

1. Surrogate assisted reliability-based design optimization of novel Spear-In-Sand launch vehicle spent stage recovery approach using Monte Carlo simulations. **Dasu Deva Karthik Lakshman** and Pankaj Priyadarshi. In: *Manuscript in progress*
2. Optimal time-jerk trajectory planning of a series-parallel robotic manipulator using novel radial basis functions. **Dasu Deva Karthik Lakshman**, Anirudh R, and Manu V Unnithan. In: textitManuscript in progress

Conference Proceedings

1. Study of Crew Seat Impact Attenuation System for Indian Manned Space Mission. Nohin K Avirah, **Dasu Deva Karthik Lakshman**, Sai Santhosh Potnuru, Athul P Pramod, and Sabin Kurian. In: *SAE AeroCON 2024.*
2. Optimal Smooth Trajectory Planning of Robotic Manipulator for Additive Manufacturing in Space. **Dasu Deva Karthik Lakshman**, Anirudh R, and Manu V Unnithan. In: *INSARM ARMS'23.*

Theses

1. Multi Disciplinary Design Optimization of Vertically Landing Stage Recovery of Launch Vehicle. **Dasu Deva Karthik Lakshman**. In: Bachelor's thesis, AE'22, IIST.
2. Multi-Disciplinary Design Optimization of Small Size Expendable Launch Vehicle. **Dasu Deva Karthik Lakshman** and Shashwat Gupta. In: Internship thesis, AE'21, IIST.

Skills

Programming Languages: Python, C++
Tools and sofwares: MATLAB, Simulink, Simscape, Octave, LaTeX, SolidWorks, ABAQUS, AnSys
Frameworks: NumPy, Pandas, SciPy, SymPy, Matplotlib, Seaborn, Plotly, scikit-learn, Keras, TensorFlow
Relevant Courses: Space Flight Mechanics, Atmospheric Flight Mechanics, Multi-Rigid Body Dynamics, Applied Dynamics and Vibrations, Optimization Techniques in Engineering, Aerospace Vehicle Design, Machine Learning for Signal Processing
Mentorship & teaching: Mentored the freshmen students in launch vehicle design and trajecory optimization at IIST. Currently supervising a project on control of series-parallel robotic manipulator.

Awards & Achievements

- Best paper award in both **Aerospace** and **Overall Industry** tracks at **SAE AeroCON 2024**.
- Consistent **Outstanding performance** achievement at VSSC, ISRO for 2023-24, 2024-25.
- **Department of Space** merit student assistantship for four consecutive years, 2018-2022.
- **Top 0.88%** in **JEE Main (2018)** examination among 1.05 million students.
- **Top 2.8%** in **JEE Advanced (2018)** examination among 224,000 students.