PMRF-ISSS Teaching Programme

Prime Minister Research Fellowship students' teaching requirement facilitated by the Institute of Smart Structures and Systems

Module **PMRF-ISSS048/II/2025**

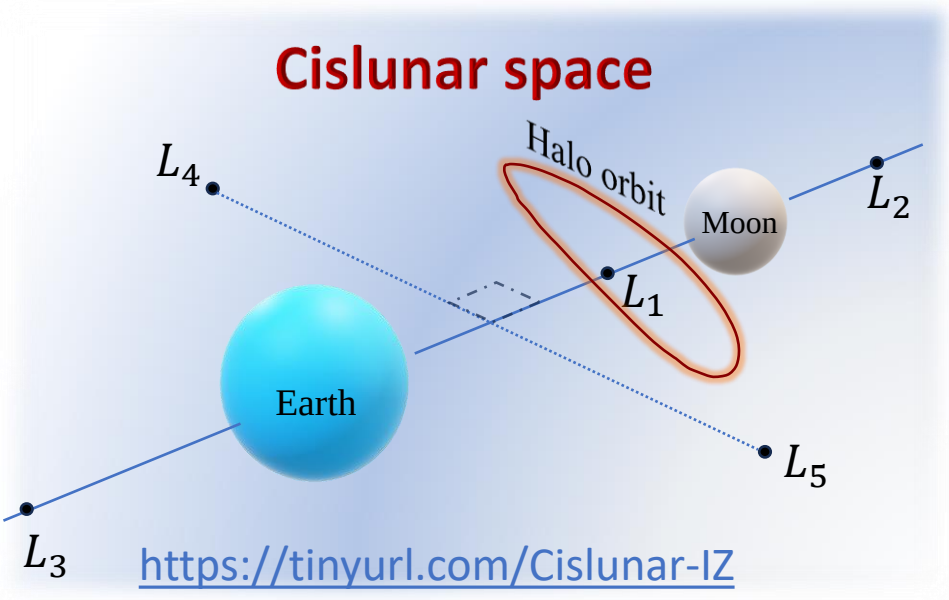
Three-Body Problem

Name of the PMRF student

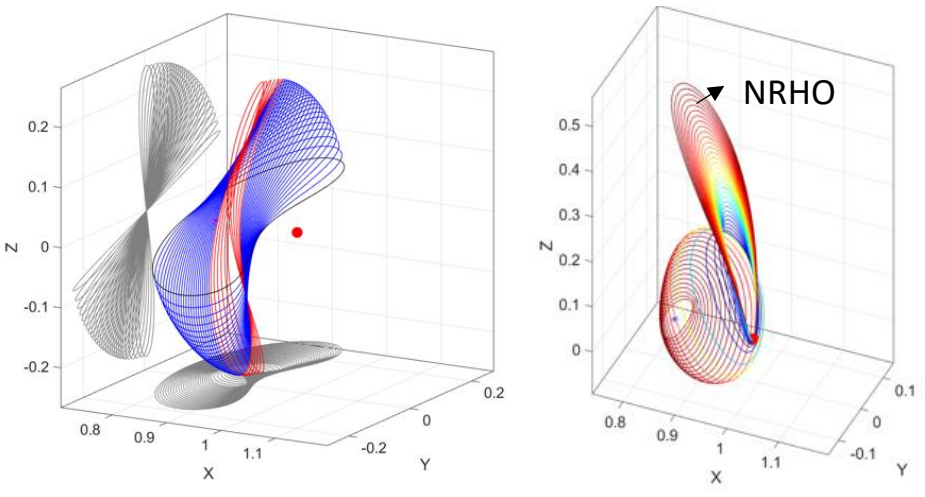
Ishfaq Zahoor Bhat

Required background of the students taught

Postgraduate/ Undergraduate course: Aeronautical, Mechanical, Aerospace, Physics having good knowledge of mechanics and mathematics (Calculus and Linear Algebra)



https://tinyurl.com/Cislunar-IZ



Axial Halo

Families of periodic orbits in about L1 [Ref]

This course covers the dynamics of three-body systems, introduces numerical methods for identifying periodic orbits, and explores the different families these orbits form. This course will give you foundation to learn about the execution of space missions: interplanetary transfers, station keeping, Space Domain Awareness (SDA) etc.

Details of the content of the module

The module will be completed in 20 lectures for a duration of 40 hours and will cover the following topics.

1. Equations of motion in different frames (Overview)
2. Eigenvalues and Eigenvectors (Overview)
3. Introduction to Three-Body Problem
4. Equations of Circular Restricted Three Body Problem (CR3BP)
5. Lagrange approach.
6. Jacobi constant and realms of possible motions
7. Equilibrium points in CR3BP
8. Linearization about L1/L2 and appearance of trajectories about the same.
9. Two level correction methods.
10. Differential correction methods (DCM) to get periodic orbits.
11. Implementation of DCM to get halo, Lyapunov and axial families.
12. Miscellaneous topics.

Schedule of the module

Start date : 10th May 2025

Tentative End date :11th August 2025 (tentative)

*The lectures will either be recorded and uploaded or presented live every Saturday at 2-3 pm IST

Meeting link : Will be shared later

Contact email ID: ishfaqbhat@iisc.ac.in

Registration link: https://forms.gle/4P8urFUqjhxQ4Scn6

[Ref] Ishfaq Zahoor Bhat and D. Ghose, "Natural Trajectory Transfer Between Halo Orbits for Optimal Closest Approach to Desired Orbit," 2025 IEEE Space, Aerospace and Defense Conference (SPACE) (Communicated).