

Internship in ESA's Advanced Concepts Team

On

Mapping multiple rendezvous missions to TSP, vehicle routing, MST

European Space Research and Technology Centre
ESA ESTEC

Candidates interested are encouraged to visit the ESA website:

<https://www.esa.int/gsp/ACT/about/jointheteam/>

To apply, visit:

<https://jobs.esa.int/job/Noordwijk-Intern-in-ESAs-Advanced-Concepts-Team/1001304601/>

Topic Description

Most complex interplanetary trajectory design problems that have been proposed over the past decades by the international community, for example in the context of the Global Trajectory Optimisation Competitions [1], have been successfully tackled by mapping an ideal representation of the original problem into problems of known complexity such as Minimum Spanning Trees [2], the Travelling Salesman Problem [3] or, most recently, Time Dependent Multiple Open Vehicle Routing Problems [4]. Techniques based on Ant Colony Optimisation, linear integer programming and more have then been successfully applied to solve such problems. A deeper understanding of the general applicability of these techniques is, though, lacking as most examples are mostly confined to specific problem instances and lack widely spread benchmarks / implementations.

Objectives

The objective of this internship will be mainly three:

- 1) Review the past success stories where the mapping between an interplanetary trajectory problem and a standard/known form of an NP complete problem has been carried out.
- 2) Study the trajectory optimisation problems related to multiple asteroid rendezvous, as, for example, defined in the 12th and 7th edition of GTOC.
- 3) Develop and implement, on selected cases, a solution strategy based on transcribing the problem instance into a linear programming problem and test its strengths/weaknesses.

Joining the ACT

Creativity and out-of-the-box thinking are essential in the ACT. Therefore, the team is constantly striving to be a diverse, inclusive and equitable workplace bringing together people from various backgrounds. We strongly encourage people from under-represented groups to apply to be part of our team as diversity is central to our mission and core values.

In order to make our hiring as fair as possible, we also ask applicants to not include photos in their CVs.

References

- [1] GTOC portal: https://sophia.estec.esa.int/gtoc_portal/
- [2] Luo, Ya-Zhong, et al. "GTOC X: Results and methods of National University of Defense Technology and Xi'an Satellite Control Center." Proceedings of AAS/AIAA Astrodynamics Specialist Conference. 2019.
- [3] Izzo, Dario, et al. "Evolving solutions to TSP variants for active space debris removal." Proceedings of the 2015 Annual Conference on Genetic and Evolutionary Computation. 2015.
- [4] JPL winning trajectory of the 12th edition of GTOC.