Internship in ESA's Advanced Concepts Team
On

Bioinspired strategies for combating the impact of micrometeoroids and orbital debris

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/

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Topic description

Collision of micrometeoroids and orbital debris with the structures of spacecrafts can cause damage considerable enough to affect their flight- and mission-critical systems or cause slow degradation of material properties. The traditional approach to mitigating damage is the use of either a Whipple shield consisting of a relatively thin outer bumper spaced some distance from the main spacecraft wall, or the use of honeycomb sandwich panels as the primary structural load bearing elements [1]. Despite the usefulness of these protective systems, spacecraft missions beyond Earth orbit where solar system materials are the dominant threat, might require a different approach from the ones currently being used. In nature, a wide range of biological protection strategies can be found that show resilience to impact loading [2], but their potential as sources of bioinspiration for more efficient impact resistant designs remains to be explored.

In this internship, a biodiversity-based approach [3] will be utilized to efficiently mine existing and novel biological strategies used by organisms to prevent or minimize the potentially damaging effect of impact forces. The different types of biological protective strategies will be categorized based on their structural design and functionality, and will be matched to the requirements of space applications (e.g., high velocity collision protection). Based on this, the candidate will apply the acquired knowledge to propose biomimetic design solutions for relevant space applications, which may include (but not limited to) the simulation of micrometeorite impacts to study damage phenomena or experimental validation of a 3D-printed prototype.

Candidate's task

The main framework of interest of this internship will be to advance the search for biomimetic solutions to particular problems in space applications. In addition, the candidate will contribute directly to the generation of novel solutions to micrometeorite impacts in space.

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] Schonberg, W. P. (2010). Protecting Earth-orbiting spacecraft against micro-meteoroid/orbital debris impact damage using composite structural systems and materials: An overview. Advances in Space Research, 45(6), 709-720.

[2] Islam, M. K., Hazell, P. J., Escobedo, J. P., & Wang, H. (2021). Biomimetic armour design strategies for additive manufacturing: A review. Materials & Design, 205, 109730.

[3] Broeckhoven, C., & du Plessis, A. (2022). Escaping the labyrinth of bioinspiration: biodiversity as key to successful product innovation. Advanced Functional Materials, 32(18), 2110235.