Bioinspired 4D printed composite structures for defense and aerospatial application

Numerical simulation and experiments

Context : Aerospatial and defense industries are looking for innovative ideas on enabling technologies for in-situ construction, manufacturing and maintenance of infrastructure. For example, efforts towards human exploration beyond Earth are seeing a remarkable resurgence, with an increasing number of robotic missions to the surfaces of the Moon and Mars and plans to send humans to these destinations in the near future.
Such objectives can only be realized with the appropriate infrastructure to support human presence in a sustainable manner. This includes infrastructure to shield the crew and equipment from environmental conditions or generate energy. Solar tracker systems[1] belong to solution that improve efficiency of solar panels. However they are mainly designed with electro-mechanical actuators that are prone to failure and maintenance.
In this context, we have proposed to design and manufacture novel 4D printed architectured composite materials that are able to actuate autonomously in lunar environment. Their microstructure and working principle will be inspired from sunflower *Helianthus annuus*.

We propose a Master 2 internship driven by IRDL UMR CNRS (Univ UBS-Lorient) dedicated to :
-The design step with computer aided design of smart structures triggered by temperature change.
-The composite fabrication with a customized printing device originally made in IRDL.
-The thermo-mechanical characterization step
-The numerical-experimental dialogue to settle the numerical results and propose parametric optimization to trigger a targeted morphing responsiveness and reactivity.

Skills and knowledge : We are looking for a student with a Master 2 or from an engineering school with high skills in the mechanics of composite materials. The student must be curious, open to the various disciplinary aspects of the project. Numerical simulation and additive manufacturing skills are also required as well as fluent English.
The internship extend over a period of 6 months from February 2022 to July 2022. A subsequent PhD funding is currently available

Required documents (deadline = 30 November 2021:
- CV + Motivation letter
- Certificate of the M2 manager mentioning the average writing, the rank, the size of the promotion,

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[1] https://en.wikipedia.org/wiki/Solar_tracker