POLITECNICO DI MILANO

PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 41st cycle

THEMATIC Research Field: THERMITE-FOR-DEMISE: LAB-SCALE EXPERIMENTAL TESTING, MODELING, AND CONSOLIDATION OF A NEW TECHNOLOGY FOR SPACE PLATFORM DEMISE

Monthly net income of PhDscholarship (max 36 months)
1500.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	The sustainability of the space environment requires that satellites in Low-Earth-Orbit (LEO) clear their orbit at the end of their mission through atmospheric reentry. Design for demise is a field of space engineering which develops solutions to mitigate the casualty risk originated from space debris created by reentering space platforms. Often, the aerothermal environment is not enough to destroy large spacecrafts or platforms containing hard-to-demise components. Energetic materials represent a possible solution. They can release heat in specific areas and at specific times, contributing to destruction of structures, joints, or massive parts. This PhD project explores the use of thermites. These are mixtures of metal and oxide that react and release heat. The PhD activity will contribute to the EIC-Pathfinder project THREAD (THermite REactions Assisting satellite Demise) and will develop, test, and consolidate the Thermite-For-Demise (T4D) technology. The final goal consists of studying T4D solutions to be implemented into satellites, testing them at laboratory scale, and developing and validating engineerig models that describe their efficacy. The work will contribute to building up the knolwedge base of T4D fundamentals, supporting the maturation of the technology, and preparing the exploitation at industrial level.
Methods and techniques that will be	

developed and used to carry out the research	The PhD candidate will develop experimental approaches to analyze and validate thermite-based solutions at lab-scale. Experiments will be complemented with modeling of reactivity, heat transfer, and damaging capacity. Experiments will support also the validation of the modeling approach.
Educational objectives	The objective of this PhD is to develop a multidisciplinary knowledge in the field of design-for-demise engineering. The candidate will become familiar with concepts, methods, and problems of demisability. He/she will deepen the knowledge on thermites, their use, their reaction, their applicability in a real scenario. The candidate will apply also techniques for the mechanical characterization of thermite charges. She/he will learn how to model and experiment the reaction of thermites and the effect of their exothermic reaction on satellite components.
Job opportunities	Design-for-demise is a new engineering approach under rapid spreading. The candidate finds natural application in the national, European, and worldwide aerospace industry in a sector that promises strong expansion and therefore requires strong competitiveness to maintain the top-level role that the national industry currently occupies. However, she/he also find application in numerous other high-tech industrial fields, in which thermodynamics, mechanics, compressible fluid dynamics, computational methods, and the integration of complex systems play a fundamental role, centered on but not limited to industrial engineering.
Composition of the research group	1 Full Professors 1 Associated Professors 1 Assistant Professors 3 PhD Students
Name of the research directors	Prof. Filippo Maggi

Contacts
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

The PhD candidate will receive a desk, possibly through a hot-desking procedure, and a personal computer, if needed. Apart from the compulsory ones, the PhD candidate will have the opportunity to follow additional courses and receive economic support to attend summer schools and participate in conferences. There will be the possibility of paid teaching assistantship.