



PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 39th cycle

PNRR 117 Research Field: ADVANCED STRATEGIES FOR EXPLOITATION AND SCHEDULING OF LARGE HETEROGENEOUS CONSTELLATIONS OF OBSERVATION SATELLITES

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
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	<p>The advent of large heterogeneous Earth observation constellations will enable previously inaccessible usage scenarios, such as preventive observation and monitoring of vast areas at risk of fire and landslides, glaciers, migration phenomena, and theatres of war. To date, such information is extracted as metadata from individual requests submitted by users: no optimized mode of operation exists for the scenarios listed above which allows the constellation capabilities to be fully exploited. The research first wants to identify novel approaches to answer users' high-level, end-purpose driven requests by exploiting the extended degrees of freedom domain heterogeneous constellations offer, such as different flying payloads (e.g. SAR, visible, hyperspectral) to combine, mounted on which set of satellites, with which specific acquisition modes (e.g., SPOTLIGHT or STRIPMAP for radar, STEREO, STRIP, SPOT for optical). Settling the functional dependence between the user needs and the extended free variables set will be the base to finalize, according to pre-defined key indexes, numerical architectures to get to the potential optimal combination of the available space assets. Constraints, user requests-dependent, will be taken into account, and key parameters will be scenario dependent: a fire monitoring request imposes timeliness in data acquisition and download, to ensure timely intervention; infrastructural monitoring would ask for sequential in time,</p>



	<p>identical in geometry passes to carry out interferometric analyses. The research will then focus on planning/scheduling problem-solving for the best network combination, passing through the current approaches adopted for mission management assessment with respect to the new needs. The possibility of on-board re-planning will be considered as well. The ultimate goal is to get to prototype to extensively test on different scenarios adopting a 60-satellite constellation. The research is in line with M1C2-4.1, M1.C2-2.2 and M4C2-3.3 of the PNRR.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The research will be developed in strict collaboration with Thales Alenia Space, active in the spacecraft constellation design, operations and control. A period of 6 months, not necessarily continuous, might be spent at the Company to deepen specific topics related to the research and identify the most challenging use cases to solve. The doctoral student will follow doctoral courses at the Doctoral School of the Politecnico di Milano, selected to enhance his/her competencies in the fields related to the research topic.</p>
<p>Educational objectives</p>	<p>The goal is to train a professional capable of formalizing and managing the design and development of automation of complex planning/scheduling mechanisms highly reconfigurable and operating on a network of systems. The skills acquired will make it possible to build a high-profile professional figure with engineering skills at the system administrator level, invaluable both in the development phase and in the satellite mission management phase, able to fit effectively into the industrial chain related to the heterogeneous spacecraft constellations. The training will also include the acquisition of soft skills through periodic involvement in presentation and dissemination activities. The interaction, with the midstream-related industries operational in the space sector, will strongly accompany the training with real problem-solving.</p>
<p>Job opportunities</p>	<p>Insertion in the industrial sector, not only in the Space domain, as coordinator of complex network management and operation, such as networks of vehicles and related</p>



	logistics in highly variable environments. In the midstream line as a system engineer in the Space domain.
Composition of the research group	1 Full Professors 2 Associated Professors 3 Assistant Professors 12 PhD Students
Name of the research directors	Prof. Michèle Lavagna

Contacts	
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Thales Alenia Space - Italia
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	DLR Oberpfaffenhofen (DE)
By number of months abroad	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.	