POLITECNICO DI MILANO

PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 39th cycle

PNRR 117 Research Field: ROTORCRAFT-PILOT COUPLINGS (RPC) REJECTION STRATEGIES: ARCHITECTURE DEFINITION, SIMULATION AND TESTING

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	Rotorcraft-Pilot Couplings are adverse phenomena that cause an unintended interaction between the pilot and the vehicle as the result of a triggering event. Although rather elusive phenomena that deserve further investigation, manufacturers are shifting their focus towards designing RPC-free rotorcraft, based on the understanding gathered through decades-long research endeavours. Recent developments in rotorcraft design, e.g., Fly-By-Wire and sophisticated Flight Control Systems, and the unconventional configurations foreseen for future Advanced Air Mobility and eVTOL vehicles, with even more automation, may expose new possibilities for RPC. Rejection of RPC phenomena during their early stage of development, based on the identification of RPC precursors, is a rather ambitious but also rather promising approach, although the detection of those precursors is still an open point of research. The objective of the proposed research is the development of RPC rejection strategies and their verification in suitably set-up laboratory experiments. This research addresses PNRR lines of intervention: - M1C2: digitalizzazione, innovazione e competitività nel sistema produttivo - M4C2: dalla ricerca all'impresa

Methods and techniques that will be developed and used to carry out the research	The project will be divided in: - conceptual phase, where the problem is defined, the requirements of the models and of the test system are identified, of the problem - a modelling phase, where the problem will be modelled with methods of incremental complexity, including multibody dynamics models of the cockpit, control inceptors, augmentation systems, and pilot biomechanics - an experimental phase, where the experiment will be set up and executed, based on the RPC testbed facility available in the joint Leonardo-Politecnico di Milano RPC test facility at the FRAME Sim laboratory. In detail, the control loading will be programmed to mimic the foreseen types of augmentation systems. The preparation and execution of the experiments will involve test engineers and test pilots from Leonardo Helicopter Division. The modelling and experimental phases will be executed in parallel. A 6-month internship at Leonardo Helicopter Division is foreseen for the development of the requirements and of the models of the augmentation system. A 6-month period abroad is foreseen at ZHAW.
Educational objectives	In addition to the courses required by the PhD programme, the candidate will have the opportunity to learn advanced methodologies for the modelling, simulation, and testing of complex systems related to rotorcraft aeromechanics, flight control, and human-machine interface.
Job opportunities	n addition to the essential research skills of a PhD, the candidate will gain competencies in modelling, simulation, and testing of advanced systems, that will make them suitable for working in a broad variety of highly technological fields, not limited to rotorcraft.
Composition of the research group	2 Full Professors 0 Associated Professors 1 Assistant Professors

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	8 PhD Students
Name of the research directors	Prof. Pierangelo Masarati

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)	Leonardo S.p.A.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	ZHAW
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The PhD candidate will be provided with office space and a personal computer if needed. Apart from the compulsory ones, the PhD candidate will have the opportunity to follow additional courses, receive economic support to attend summer schools and participate in conferences. There will be the possibility of paid teaching assistantship.