



PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 38th cycle

Research Area n. 3 - Systems and Control

**PNRR_351_DOTT_RICERCA Research Field: AI-ENHANCED ENGINEERING TOOLS FOR
OPTIMAL DEPLOYMENT OF COLLABORATIVE ROBOTICS APPLICATIONS**

Monthly net income of PhDscholarship (max 36 months)
€ 1250.0
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 PhD scholarship proposal is in the context of collaborative robotics, that is the newest version of industrial robotics designed for the close and safe interaction between human operators and robotic manipulators. The research aims at using artificial intelligence to improve the design and deployment phase of collaborative robotics applications.
Methods and techniques that will be developed and used to carry out the research	Collaborative robotics primarily aims to allow the use of industrial robotic manipulators in the presence of humans in safe conditions, guaranteed by the mechanical design and the control system of the robot itself. Among the various possible applications of collaborative robotics, the assembly of mechanical parts is of particular importance. Such applications have to be accurately designed and engineered in order to take optimal advantages from both the human and the robot. Part presentation, robot placement, robot movements, human and robot tasks represent typical decision variables. On the other hand, human safety and ergonomics and cycle times are typical KPIs. The design task of application engineers may be assisted by automated algorithms (capable of performing several what-if analyses in background) suggesting the engineering team suitable modifications of the layout/application for a more productive application.



Educational objectives	The candidate will master AI techniques for the design and the development of optimized collaborative robotics applications, which is expected to be a very important ingredient of the factory of the future.
Job opportunities	The job market for experts in the field of robotics, and specifically of collaborative robotics, is already large today and is expected to become even more interesting in the coming years. Opportunities to work in the research institutes will also be available.
Composition of the research group	1 Full Professors 1 Associated Professors 0 Assistant Professors 4 PhD Students
Name of the research directors	Paolo Rocco, Andrea Maria Zanchettin

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	625.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	
By number of months at the company	0
Institution or company where the	SDU (University of Southern Denmark), Denmark



candidate will spend the period abroad (name and brief description)	
By number of months abroad	6

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

ATTINENZA ALLA TEMATICA PRESCELTA

L'attività di dottorato proposta è coerente con le tematiche del PNRR e in particolare con l'attenzione posta dal piano sul sistema produttivo manifatturiero (M1C2, Digitalizzazione, Innovazione e Competitività nel Sistema Produttivo) e sull'intelligenza artificiale, concretizzate dai Partenariati estesi sul Made in Italy e sull'Intelligenza Artificiale (M4C2, Dalla Ricerca all'Impresa). La robotica è inoltre un'area fortemente interdisciplinare, che coinvolge molteplici domini scientifici e tecnici, e la ricerca proposta è decisamente intersettoriale, dal momento che i risultati che si otterranno hanno la potenzialità di essere utilizzati in svariati settori produttivi. L'adesione a reti internazionali è garantita dalla partecipazione del Politecnico di Milano all'associazione euRobotics e quindi dalla possibilità offerta al dottorando di interfacciarsi, in particolare nel corso dell'annuale Forum, con tutti gli stakeholder pubblici e privati sulla robotica a livello europeo. L'attività proposta risponde adeguatamente anche a tutti gli altri criteri previsti dal bando, vale a dire la garanzia data al dottorando di conseguire una formazione di alto livello nell'ambito dell'Università proponente usufruendo di tutti i relativi servizi (M4C1.3, Ampliamento delle Competenze e Potenziamento delle Infrastrutture), di trascorrere un adeguato periodo di formazione e ricerca complementare all'estero, di valorizzare i risultati della ricerca (M4C2, Dalla Ricerca all'Impresa) come già avvenuto nel gruppo di ricerca proponente in vari casi in passato, e di inserire il dottorando nell'ambito delle collaborazioni esistenti con altre Università.

UNIVERSITÀ PRESSO CUI SI SVOLGERÀ IL PERIODO DI STUDIO E RICERCA ALL'ESTERO

- Department of Technology and Innovation, SDU (University of Southern Denmark), Denmark
- automazione, digital twin, robotica, manifatturiero
- https://www.sdu.dk/en/om_sdu/institutter_centre/iti
- 6 mesi
- Il dottorando raffinerà e arricchirà le metodologie sviluppate nel corso del dottorato, applicandole a casi studio rilevanti e di interesse industriale

EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student 5.095,96 Euro

TEACHING ASSISTANTSHIP: (availability of funding in recognition of supporting teaching activities by the PhD student)

There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

COMPUTER AVAILABILITY: individual use



DESK AVAILABILITY: individual use