POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

PARTENARIATO PNRR Research Field: TOWARDS ZERO ON SITE TESTING FOR RAILWAY SIGNALLING SYSTEMS

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	Signalling is an essential part of railway transport for the safety and the regularity of service operation. It is based on the exchange of information between the train on-board unit and a ground-based infrastructure (Radio Block Center, RBC). The implementation and field testing of already existing or new signalling system is usually highly time consuming, therefore there is a strong interest by manufacturers and railway operators to reduce the time required for the acceptance and the homologation of a signalling system. The research activity is financed and developed within the Sustainable Mobility Center (*Centro Nazionale per la Mobilità Sostenibile* - CN MS) - Spoke 4 (Rail transportation - *Trasporto ferroviario*), as part of the National Plan for Recovery and Resilience (PNRR, M4 C2 *Dalla Ricerca all'Impresa*). Norms of Reference: CUP: D43C22001180001 - D.D. 1033 del 17/06/2022 D.D. 3138 del 16/12/2021 rettificato con D.D. 3175 del 18/12/2021 Avviso pubblico per la presentazione di proposte di intervento per il Potenziamento di strutture di ricerca e creazione di "campioni nazionali" di R&S su alcune Key Enabling Technologies da finanziare nell'ambito del Piano Nazionale di Ripresa e Resilienza,

	Missione 4 Componente 2 Investimento 1.4 "Potenziamento strutture di ricerca e creazione di "campioni nazionali" di R&S su alcune Key Enabling Technologies" finanziato dall'Unione Europea - NextGenerationEU.
Methods and techniques that will be developed and used to carry out the research	• Development of comprehensive simulation tools, including train longitudinal dynamics, RBC functionalities, communication with the on-board unit; • Simulation of different operating scenarios in terms of line layout, route, and timetable; • Expansion of the simulation tools into a HiL test bench combining virtual and physical components, through a modular approach; • Quantitative comparison of the performances of different signaling systems (e.g. service regularity, energy efficiency, etc.), in order to establish a more convenient architecture of signalling system according to the target serviced and network; • Possibility of including delays, disturbances, lack of communication and uncertainties in train positioning, so as to evaluate the dynamic response of the system and the associated effects on train operation, regularity of the service, the recovery of a regular condition and/or alternative procedures to regain full operational status. The candidate shall contribute to the development of advanced simulation tools. He/she will take part in the test bench implementation, in the execution of the tests and in the analysis of the results.
Educational objectives	The candidate will acquire high-profile skills and will be dealing with both theoretical and experimental methodologies. He/she will develop knowledge in the following areas: • analysis of complex dynamic systems with different methods and approach (numerical simulation, co-simulation of interacting virtual and physical components, discrete event dynamic systems);

	• analysis and optimisation of the performance of complex systems; • technology and innovation in signalling systems. Finally, the candidate will gain the capability of working and cooperating in a multidisciplinary team.
Job opportunities	Future job opportunities are primarily in the railway engineering field, including railway industry, engineering and project management companies, operators and infrastructure managers. In particular, he/she will acquire specific competencies of great interest for the companies working in the field of the design, implementation and management of signalling systems. Besides this, job opportunities comprise national and international academic and non academic institutions and organizations, engaged in innovation, research and technical development. Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared to Master of Science holders in the same field. The research project will involve the cooperation of the following institutions: Università di Firenze, Università di Roma La Sapienza, Hitachi Rail Italy.
Composition of the research group	3 Full Professors 1 Associated Professors 1 Assistant Professors 1 PhD Students
Name of the research directors	Proff. Bocciolone, Collina, Corradi

Contacts
Research Directors: - Prof. Marco Bocciolone - Prof. Andrea Collina - Prof. Roberto Corradi *Phone:* +39 02 2399 8493, *Email:* roberto.corradi@polimi.it

For questions about scholarship/support please contact phd-dmec@polimi.it (+ 02 2399 8555).

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

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

Financial aid is available for all PhD candidates (purchase of study books and materials, funding for participation in courses, summer schools, workshops and conferences) for a total amount of euro 5.707,13.

Our candidates are strongly encouraged to spend a research period abroad, joining high-level research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approx. 700 euro/month - net amount).

Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD candidate. 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.