

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 41st cycle

THEMATIC Research Field: DEVELOPMENT OF AN ULTRA-HIGH PERFORMANCE VEHICLE

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	 Ultra-high performance vehicles are not just fast cars, they represent the peak of automotive design, blending race-inspired engineering with luxury craftsmanship. The search forextreme levels of speed, acceleration and handling yields to face several technical challenges, among which: Aerodynamics: achieving optimal downforce and minimal drag while maintaining a visually appealing design addressing the fluid structure interactions between the aerodynamic components of the car and the surrounding flow; Powertrain: define the best layout, which may feature an hybrid architecture for the delivering the requested propulsion power at high speed; Tyre technology: development of tyres able to safely handle extreme speeds, loads and temperatures; Suspensions and steering system: creating suspension and steering systems that handle road roughness and asperities while maintaining comfort and stability; Braking system: designing brakes that can decelerate the vehicle from very high speeds repeatedly without fading; Lightweight design: use of advanced materials (CFRP,) to reduce mass while ensuring reliability; 	



	components so to maintain performance and avoid failures. Aim of the research is identifying the most important challenges in designing ultra-high performance vehicles and finding a solution based on numerical models and experimental data.
Methods and techniques that will be developed and used to carry out the research	The research is characterized by a strong interdisciplinary approach. To achieve the objectives of the research, a comprehensive and systematic approach will be employed, utilizing the analytical, numerical, and experimental tools. The methods and techniques will encompass several key areas, including algorithm development, system integration, performance evaluation, human feedback analysis. More in particular, the research will be structured as follows: • State of the art research on ultra-high performance road vehicles and identification of the main challenges; • Definition of KPIs (performance, stability, controllability, road holding, comfort,); • Development of the ultra-high performance vehicle model (powertrain, suspensions, tyres behaviour at high speed, aeroelastic (dynamic) modelling, road unevenness,); • Model validation; • Vehicle parameters optimal setting for reaching the target KPIs using the developed model. The research may also feature • a subjective evaluation of the selected setups through dynamic driving simulator tests • assessment of vehicle aerodynamics.
Educational objectives	The challenges that the candidate will have to face are both theoretical and experimental.Specifically, the candidate will acquire high-level skills and will work on some of the most fascinating and challenging problems in the automotive industry, i.e. the design of ultra-high performance vehicles.The candidate will become an expert in vehicle modelling, performance evaluation and



	optimal design.
Job opportunities	Future job opportunities primarily lie within the automotive sector, including R&D departments of automotive industries such as automobile manufacturers and suppliers of vehicle components. Additionally, opportunities exist in national and international academic and non-academic institutions and organizations engaged in innovation, research, and technical development. Furthermore, according to our latest survey of MeccPhD Doctorate, there is a 100% employment rate within the first year, with salaries being 35% higher compared to Master of Science holders in the same field. Employment statistics of PhDs can be found at: https://cm.careerservice.polimi.it/en/employment- statistics/
Composition of the research group	4 Full Professors 5 Associated Professors 2 Assistant Professors 15 PhD Students
Name of the research directors	Prof. M. Gobbi - Prof. E. Sabbioni

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

Financial aid is available for all PhD candidates (purchase of study books and materials, fundingfor participation in courses, summer schools, workshops and conferences) for a total amount of \in 6.114,50.

Our candidates are strongly encouraged to spend a research period abroad, joining high-

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levelresearch 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. 750 euro/month- net amount). Additionally, PhD candidates who spend at least 3 months abroad are eligible for an extra reimbursement of €3,000 to cover travel expenses. 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 theteaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.