



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 37th cycle

Research Area n. 1 - Advanced Materials and Smart Structures

**THEMATIC Research Field: ANALYSIS OF DIFFERENT SENSOR TECHNOLOGY
SOLUTIONS ON SENSORISED TYRE PERFORMANCES**

Monthly net income of PhDscholarship (max 36 months)

€ 1325.0

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**

Turning passive components into smart devices opens completely new perspectives in several fields. Tyres are the elements of a vehicle in direct contact with the ground and have to perform several functions. They have to sustain the vehicle weight, develop the contact forces that control the vehicle direction and speed, prevent hydroplaning, display adequate resistance towards cyclical loads, punctures, wear and ageing. Smart tyres are sensorised components that provide information about inflating pressure, contact forces, potential friction, hydroplaning proximity and others. Nowadays, these data can be estimated by processing signals coming from onboard sensors. Implementing smart tyres on commercial vehicles would grant direct access to this information, boosting the development of ADAS and automated driving. The target of the research is the optimization of the architecture of the sensing devices that make a tyre smart. The sensing devices have to satisfy a series of requirements: they should monitor the tyre dynamics without affecting it, they should have a minimal impact on the production process, they should not detach from the tyre as a consequence of high rolling speeds or impacts against obstacles, they should not cause the rise of additional stresses that may affect fatigue life and structural integrity. The candidate will have to model the



	interaction between the tire and different types of sensing devices, optimizing their internal architecture and their connection with the component.
Methods and techniques that will be developed and used to carry out the research	This research will be carried out mainly from a numerical point of view. Lumped-parameter model of sensing devices will be combined with FEA models of the tyre. Sensing devices developed with several technologies will be considered. The connection between the sensing device and the tyre is a critical element for this technology and will be carefully modelled and investigated. The research will be carried out in cooperation with an industrial partner that will provide adequate support for the development of the models. Experimental data will be used for model validation and for identifying the model parameters. The activity will be carried out in part at the Department of Mechanical Engineering of Politecnico di Milano and in part at the headquarter of the industrial partner.
Educational objectives	Combine and master different modelling techniques; Develop competences on innovative components; Develop team-working attitude
Job opportunities	Tyre manufacturers; Vehicles manufacturers; Developers of ADAS systems or autonomous vehicles
Composition of the research group	1 Full Professors 2 Associated Professors 0 Assistant Professors 0 PhD Students
Name of the research directors	Proff. Stefano Melzi, Edoardo 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 (more than 80Km out of Milano)	--



Scholarship Increase for a period abroad	
Amount monthly	564.01 €
By number of months	6

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

Funding for educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences); funding per PhD student per year: 2nd year: per student euros 1.534 3rd year: per student euros 1.534. Teaching assistantship: availability of funding in recognition of support to 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:** 1st year: individual use 2nd year: individual use 3rd year: individual use **Desk availability:** 1st year: individual use 2nd year: individual use 3rd year: individual use