



# PhD in INGEGNERIA DEI MATERIALI / MATERIALS ENGINEERING - 40th cycle

## PNRR 630 Research Field: ADVANCED PERFORMANCE OF ATHLETICS TRACKS SURFACES

Monthly net income of PhDscholarship (max 36 months)
<b>€ 1400.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
<b>Motivation and objectives of the research in this field</b>	<p>Numerical modelling of athletics tracks has been developed in the past few years, allowing for a fully 3D description of the track geometry within a FEA framework. The use of visco-hyperelastic constitutive modelling of the materials behaviour, coupled with a semi-analytical approach to account for the influence of friction, represents the state of the art in this field.</p> <p>Such a model offers a valuable tool to optimize the track geometry, something which at present has been carried out in view of a widely employed parameter known as force reduction.</p> <p>The goal of the present activity is to further investigate the performance aspects, in view of further optimization. This will involve not only geometrical aspects, but also material formulation and in particular the inclusion of recyclable/renewable materials to reduce resource consumption and the environmental impact for the newly developed solutions, promoting advancement towards a circular economy paradigm.</p>
<b>Methods and techniques that will be developed and used to carry out the research</b>	<p>The research, supported by Mondo S.p.A., will involve extensive use of the existing modelling tools to explore the influence of several variables: the track production process, material formulation, additional geometrical parameters, use of AI-driven shape generation tools, multi-objective optimization (for different types of surfaces), ageing.</p> <p>Additionally, a more detailed and comprehensive</p>



	<p>Additionally, a more detailed and comprehensive description of the interaction between athletes and sport surface will guide towards the identification of suitable performance indexes, whose determination will be validated by selecting reliable models and experimental testing protocols.</p>
<b>Educational objectives</b>	<p>The main challenges facing the PhD candidate will involve the use of advanced modelling techniques, in presence of complex conditions: high strains, nonlinear behaviour, dynamic contact with very high friction. Efficient management of the available computational resources will be a key goal to be achieved. Meanwhile, the PhD candidate will acquire very good knowledge of the state-of-the-art experimental protocols used to characterize experimentally the behaviour of sports surfaces.</p>
<b>Job opportunities</b>	<p>A good knowledge of advanced modelling techniques can be immediately used in a very large number of industrial sectors, in which polymeric (and elastomeric in particular) components are used. Moreover, the exploration of performance indexes related to athlete/surface interaction is a very important topic in the broader context of sport engineering, not limited to the field of sports surfaces.</p>
<b>Composition of the research group</b>	<p>1 Full Professors 3 Associated Professors 3 Assistant Professors 8 PhD Students</p>
<b>Name of the research directors</b>	<p>Prof. Luca Andena</p>

<b>Contacts</b>	
<p><a href="https://www.cmic.polimi.it/ricerca/elenco-gruppi-di-ricerca/polyenglab/">https://www.cmic.polimi.it/ricerca/elenco-gruppi-di-ricerca/polyenglab/</a></p>	

<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--



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)	Mondo SpA 12051 Alba, Frazione Gallo <a href="http://www.mondoworldwide.com">www.mondoworldwide.com</a>
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	to be defined
By number of months abroad	6

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

**Confidentiality:** since this is a thematic scholarship, the management of Confidential Information, Results and their publication is subordinate to the restrictions agreed upon with the funding company.

Upon acceptance of the scholarship, the beneficiary must sign a specific commitment.

**Individual budget for research (tot. 5.700 euro):**

- 1st year: 1.900 euro;
- 2nd year: 1.900 euro;
- 3rd year: 1.900 euro

**Teaching assistantship** (availability of funding in recognition of supporting teaching activities by the PhD student): there are various forms of financial 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 regulation.