



**Call for applications for join internship project  
ArcelorMittal – MINES Paris  
in modelling and simulation of cold rolling**

ArcelorMittal is the **world's largest steel producer**. We use the most innovative technology to create the **steels tomorrow's world will be made of**. Every day over 190,000 of our talented people, located in over 60 countries, push the boundaries of digitalization and use advanced technology to create a world that is stronger, faster and smarter. To help make this possible, they know they can depend on the support and training that a company of our scope and scale can provide.

Our goal is **to help build a better world with smarter steels**. Steels made using innovative processes which use less energy, emit significantly less carbon and reduce costs. Steels that are cleaner, stronger and reusable. Steels for electric vehicles and renewable energy infrastructure that will support societies as they transform through this century. With steel at our core, our inventive people and an entrepreneurial culture at heart, we will support the world in making that change. This is what we believe it takes to be the **steel company of the future**.

ArcelorMittal is listed on the stock exchanges of New York (MT), Amsterdam (MT), Paris (MT), Luxembourg (MT) and on the Spanish stock exchanges of Barcelona, Bilbao, Madrid and Valencia (MTS). For more information about ArcelorMittal please visit: <http://corporate.arcelormittal.com>

The Centre des Matériaux (<https://www.mat.minesparis.psl.eu>) is a research laboratory of MINES Paris, PSL University and CNRS UMR 7633. Its workforce consists of 190 people including 45 researchers and scientists, 35 technical and administrative staff and 80 doctoral students. Research activities apply to all types of materials of industrial interest and its action falls under three main missions: Research, Teaching and Valorisation.

**Research:** The Centre carries out scientific research of the highest international standard on topics of industrial interest. The fields of application range from physical properties of materials to modelling and numerical simulations with in-house software Z-set (<http://www.zset-software.com>).

**Teaching & training:** Our researchers participate in teaching of the engineering cycle of MINES Paris and at different universities in the Paris region, at the bachelor's or master's level, in addition the laboratory manages a specialized master's degree in Design of Materials and Structures (DMS).

**Valorisation:** The importance of this activity of promoting research results is illustrated by the fact that half of the total resources result, via ARMINES, from research contracts involving French and international industrial partners. The reputation of the Centre has been established thanks to the complementarity of these three missions, which has enabled it to train more than 500 engineers and PhDs who, for the most part, are employed in industrial companies.

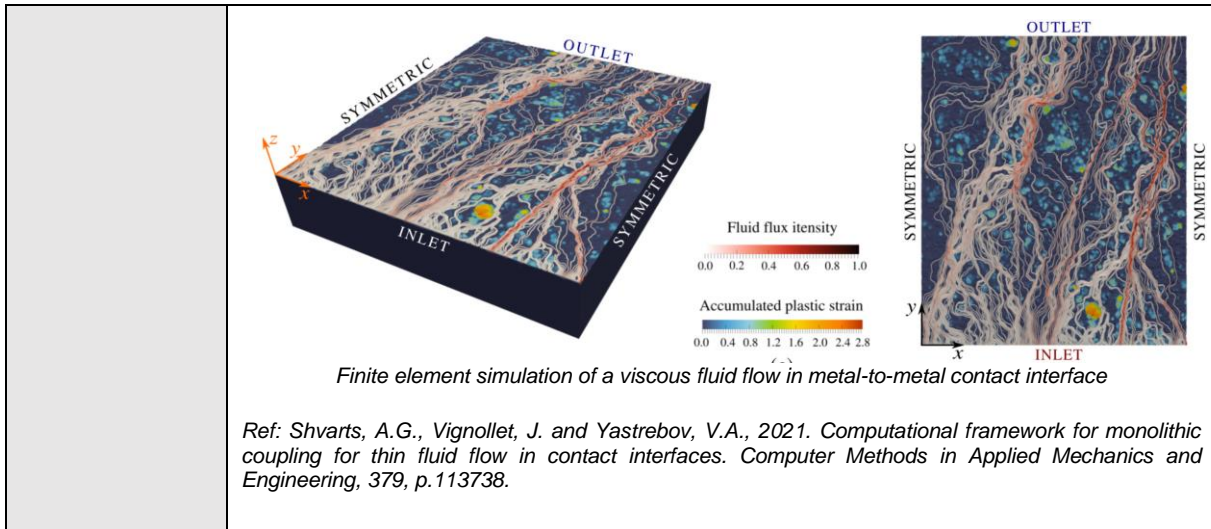
Internship information	
Mission title	<b>Finite Element Modelling of Lubricated Contact Interfaces in Cold Rolling.</b>
Contract type	Internship
Start date	March – September 2023
Duration	6 months
Research center	MINES Paris ( <i>in collaboration with ArcelorMittal R&amp;D Maizières Processes</i> )
Department	Centre des Matériaux
City	Evry, Essonnes (35 km from Paris)
Country	France



Trainee's profile	
Studies level	Master's degree
Discipline (+ School/University)	Engineering school / Master of science
Internship requirement and competencies	Solid & Fluid Mechanics, Finite Element Modelling
Languages (+ levels)	Fluent in English, mastering French is a plus

Mission	
Purpose of the mission	<p>With the development of electric cars in automotive industry, steel manufacturers must adapt their processes to this growing demand. Steelmaking processes have to be more efficient and must reduce their carbon footprint.</p> <p>Cold rolling process is an important step in the steelmaking processes. For cold rolling of flat products, the process capability defines the final products' thickness. The control of lubrication is the key to reach higher capabilities and decrease energy consumption in cold rolling processes.</p> <p><b>The purpose of the internship is to build and improve a finite element modelling procedure to be able to reproduce locally a lubricated contact interface between strip and roll in the cold rolling process.</b></p>
Accountabilities and activities	<p>Based on A. G. Shvarts and V. A. Yastrebov previous work on finite element modelling of liquid entrapment at contact interfaces (see references and figures) the intern will be entrusted with the following missions:</p> <ul style="list-style-type: none"> <li>• adapt these modelling conditions for cold rolling processes to analyse the impact of process parameters (rolling temperature, rolling speed, lubricant nature, thickness reduction) on oil behaviour at contact interface</li> <li>• improve the model to better account for the effect of some process parameters (tangential velocity of the two surfaces in contact, non-deterministic surface roughness morphology)</li> </ul> <p>The internship will be performed in collaboration with ArcelorMittal R&amp;D Maizières Process, Maizières-lès-Metz, France.</p> <div style="text-align: center;"> <p>(a) (b)</p> </div> <p>Trapped fluid in contact interface in inactive state (a) and active state (b).</p> <p>Ref: A.G. <b>Shvarts</b>, V.A. <b>Yastrebov</b>. "Trapped fluid in contact interface". <i>Journal of the Mechanics and Physics of Solids</i>, 119:140-162 (2018).</p>

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Application	
Documents	To apply to this enumerated internship, we ask potential candidates to send the following documents: - CV (English or French) - Academic record - Cover letter (English or French)

Contact	
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