Multiscale modeling of thermomechanical, vibrational and acoustic properties of modified ballast

The degradation of ballast properties under dynamical stresses imposed by the circulation of trains shows that the latter is not resistant and gradually worn by fragmentation of the grains at the contacts. This behavior strongly depends on the shape, size and mineralogical nature of the grains composing it. In order to find solutions for prolonging ballast lifespan, it is crucial, first, to understand the origins and mechanisms leading to ballast degradation when it is subjected to complex loading.
The objective of this project is to use multiscale numerical modeling to analyze and improve the strength, the durability as well as vibrational and acoustic properties of railroad ballast under external loading and environmental conditions. We will develop models to describe the morphology of grains, their sizes, the porosity effects as well as their surface contacts and grain cohesion.
We aim at the end to predict the “ballast of the future” by applying a coating on its surface or by changing its mineralogical nature to reinforce its thermomechanical, vibrational and acoustic properties.

Good knowledge on computational tools such as Molecular dynamics and multiscale approaches is necessary.

The position is for one year to be extended to another one.

Candidates should send a pdf file of CV including a list of publications, and references to:

Prof. Ali Zaoui, email: ali.zaoui@univ-lille.fr