Joint Research Unit in
Environmental Acoustics
(University Gustave Eiffel – Cerema)

INTERNSHIP PROPOSITION 2024

Subject

Modelling vibration excitation due to railway crossings

Recommended level

☒Master (M2) ☐Master (M1) ☒Ingénieur ☐Licence ☐Bac + 2

Compétences requises

Vibrations, Structural dynamics, Numerical methods, Python/Matlab

Description

Background. *When a rail vehicle crosses a turnout, the wheels impact with the core of the turnout. Such impacts generate not only noise, but also vibrations in the infrastructure and the ground, which can propagate to buildings, causing annoyance to local residents.*

In impact studies prior to the construction or modification of a railway infrastructure, these switches and crossings are generally taken into account on a lump-sum basis, via a majorizing factor derived from an experimental estimate. Their position cannot generally be altered, and solutions for reducing them, particularly with regard to vibrations, are very limited.

Scientific problem*. Numerous studies have been carried out to model the vibratory excitation associated with the rolling of a train on a track, the aim being to determine the forces generated on the rail by the geometric and mechanical characteristics of the rolling stock and the infrastructure. The models used generally consider the dynamic interaction between a wheel and a track, generated by surface irregularities at the wheel-rail contact. In the absence of a singular point, the profile of surface defects is stationary and their amplitude remains low (wheel/rail roughness). In this case, the interaction is usually modelled in 2D in the frequency domain. Passing over a turnout induces transient, non-linear phenomena that need to be dealt with in the time domain.*

Objective of the internship. *The aim of this internship is to develop a tool based on a dynamic wheel/track interaction model. The first step will be to compile a bibliography on this issue, covering both acoustic and vibratory aspects. On the basis of this literature review, the student will select a method suitable for engineering purposes, and then develop a calculation tool for assessing vibration excitation when a train passes over a turnout. The tool will be validated on the basis of existing literature results.*

Depending on the progress of the modelling work and the student's motivations, he/she may make other contributions, such as comparison with existing experimental data, setting up complementary tests, or carrying out parametric studies with the aim of reducing vibrations.

Internship location

☒ **Uni Eiffel, Campus Lyon** (25, avenue François Mitterrand, Case24, Cité des mobilités, F-69675 Bron Cedex)

☐ **Uni Eiffel, Campus Nantes** (route de Bouaye, CS4, F-44344 Bouguenais Cedex)

☐ **Cerema – Strasbourg** (11, rue Jean Mentelin, Strasbourg-Koenigshoffen, F-67035 Strasbourg)

Internship duration *(detailed dates have to be adapted)*

Starting date: 01/03/2024
End date: 31/07/2024
Duration: 5 months

Contact

M. Olivier CHIELLO
Tel. 04 72 14 24 05
Email: olivier.chiello@univ-eiffel.fr
www.umrae.fr

M. Pierre ROPARS
Tél. : 04 76 76 25 25
Email : pierre.ropars@cstb.fr

Gratification

Indemnity equivalent to 15% of the hourly ceiling of the Social Security, for a public organization
https://www.service-public.fr/simulateur/calcul/gratification-stagiaire