Topic of the post-doctorate

Coupling between multi-agent road traffic and noise models to assess sustainable mobility solutions

Skills and training requirements

Disciplines: Environmental acoustics (physical modeling) / Transportation

Description

The quantification and reduction of exposure to noise generated by road traffic is a crucial issue for metropolitan areas, both in terms of health and attractiveness. Modeling chains that combine traffic and noise modeling make it possible to estimate the spatial distribution of noise (noise levels in a receiver map). Recent work has shown the interest of using detailed road traffic modeling to improve estimates. The coupling between road traffic simulation and noise models has been successfully developed at the neighborhood scale.

However, some mobility plans impact sound environments at larger scales. At the city scale, agent-based models such as MATSim seem a promising way to take into account the temporal and spatial dynamics of both noise emission and noise exposure, in order to improve the estimation of exposure to noise.

The objective of the post-doctoral fellow is to develop agent-based modelling to study the changes in the spatial and temporal distribution of environmental externalities (pollution, noise) required for the multi-criteria evaluation of the proposed solutions. Emphasis will be placed on the acoustic part, for which there are more current scientific locks; air pollution will be integrated via existing modules, as part of multi-criteria assessments.

This work is part of the project Mutandis (Innovative solutions for sustainable mobility in periurban areas), one of the objectives of which is to assess the impacts of the new mobility solutions deployed in peri-urban areas on the environment (emissions, noise), on health and on socio-spatial inequalities. Insofar as the project is primarily concerned with the impact on mobility of innovative solutions, it becomes possible to use the outputs of these mobility models to propose innovative multi-criteria analyses at the scale of the territory considered, such as the production of noise indicators and/or maps. In a second step, the associated social and economic aspects (environmental injustice, land costs, etc.) can be studied.

More in detail, the work will consist first in technically coupling the Matsim[1] and Noisemodelling[2] tools. Noisemodelling is an open-source library capable of producing noise maps of cities, developed partly at UMRAE. The resulting modeling chain will then be used to assess multi-criteria analyses of the mobility plans, and answer research questions about socio-spatial inequalities. To do this, the post-doctoral student will be part of a teamwork, interacting with researchers from the host laboratories in the acoustic and economic fields, and will take advantage of the technical skills of computer scientists. Close interactions with a doctorate student working on MATSim are also expected.

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[1] MATSim is an open-source framework to implement large-scale agent-based transport simulations, where a large number of individuals are simulated (https://www.matsim.org/).

[2] NoiseModelling is open-source tool, integrated in the OrbisGIS software, designed to produce environmental noise maps (https://noisemodelling.readthedocs.io/en/latest/).

The results of this research will be used in at least two publications in international journals or conferences with an environmental impact

References :

Bocher E., Guillaume G., Picaut J., Petit G., Fortin N. (2019). NoiseModelling: An Open Source GIS Based Tool to Produce Environmental Noise Maps. International Journal of Geo-Information, 8(3), 130; https://doi.org/10.3390/ijgi8030130

Can, A., Leclercq, L., Lelong, J., & Defrance, J. (2009). Accounting for traffic dynamics improves noise assessment: experimental evidence. Applied Acoustics, 70(6), 821–829.

Horni, A., Nagel, K., & Axhausen, K.W. (2016). The Multi-Agent Transport Simulation MATSim. London: Ubiquity Press. DOI: http://dx.doi.org/10.5334/baw. License: CC-BY 4.0.

Kaddoura, I., Kröger, L., Nagel, K. (2017). An activity-based and dynamic approach to calculate road traffic noise damages. Transportation Research Part D : Transport and Environment, 54 :335–347.

Kuehnel N., Kaddoura I., Moeckel R. (2019). Noise Shielding in an Agent-Based Transport Model Using Volunteered Geograpihic Data. Procedia Computer Science 151, 808-813.

Candidate profile

The candidate will have a solid background in acoustics or road traffic modelling / multi-agent models. A good level in English is essential, as well as a good practice of a programming language.

Location

The thesis will take place at the UMRAE, on the Ifsttar site in Nantes.

Contact

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Supervisors

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Funding

This postdoctoral position is a temporary position for one year. The start of the contract is expected between March and June 2020. The wage is approximately 2000€ net per month.