Methods And Algorithms For Sound Propagation In Complex Environments With Application To Urban Air Mobility

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Numerous Urban Air Mobility (UAM) researchers and developers have highlighted noise generation as one of the greatest threats to the implementation of large-scale UAM operations and a key development goal of UAM aircraft [1]–[5]. Reference [6] conducts an extensive review of the state of the art in aircraft noise prediction and suggests that effectively reducing aircraft noise annoyance requires a balanced approach that addresses noise through several means, namely:

- Noise reduction at the source through engine and airframe technologies
- Noise reduction through operations such as low noise procedures and trajectories
- Noise reduction at the destination through compatible land use and urban development
- Noise reduction through operational restrictions such as flight quotas, noise limits, or curfews

In this regard, it is necessary to perform noise impact analysis to reduce VTOL aircraft noise annoyance through operations, compatible land use and urban development.
In this research, the sound sources of VTOL vehicles at different operating conditions will be predicted by employing the Lattice-Boltzmann/Very-Large-Eddy-Simulation (LB/VLES) method. The effects of wind and temperature variations on long-range sound propagation will be studied with ray acoustics whereas the sound propagation in an urban environment will be examined using Lattice-Boltzmann method (LBM). Moreover, the effects of different spatial interpolation techniques on the accuracy of three-dimensional noise mapping within a GIS platform will be investigated. A schematic illustration of the research process is shown in Fig.1.

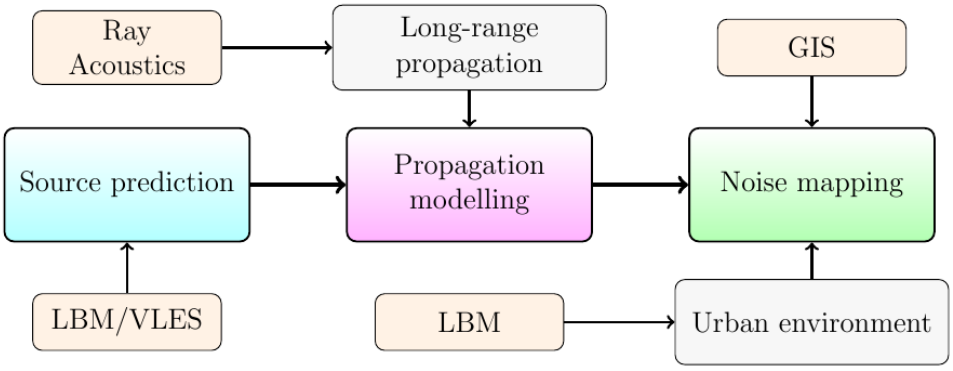

Figure 1: A schematic illustration of the research process.

References

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