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The development and Applications of the Computation Fluid Dynamics with Immersed Boundary Method for Wind Engineering in Urban

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In modern cities, there are high constructions and complex forms which can involve significant problems of wind discomfort around the buildings. Wind tunnel tests give wind relevant results and stay a reference for new methods' validity investigations. Working with physical models makes to study some precise location as to test different hypothesis. Limitation of wind tunnels is such tools scarcity, especially when big enough tunnels are needed for investigations on urban models, and the choice of a limited number of measurement points in the models.

Computational fluid dynamics (CFD) simulations programs are also very powerful tools for modelling the wind around buildings. They have a huge advantage over wind tunnel tests: give a quantitative and qualitative wind flow representation of the whole volume simulated and not only in a few specific points related to the presence of measure instruments. However, the pre-processings (including complex terrain model, building modeling, computing mesh generation) are very complicated and time-consuming for the urban applications in CFD.

In this study, we try to integrate the digital terrain model (DTM), digital surface model (DSM), and CFD with immersed boundary method (IBM) allowing computation of wind flow at high resolution in an urban environment. Some examples of applications to wind safety, outdoor climatic comfort, energy saving was shown. From the results, the tool available and can be used easily in civil engineering for a very large spectrum of applications.

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