Mechanical Engineering Master's Defense

Numerical Simulation of Environmental Flow over Urban Landscape for Applications to Renewable Energy

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abstract

Development of renewable energy solutions has become a major interest among environmental organizations and governments around the world due to an increase in energy consumption and global warming. One fast growing renewable energy solution is the application of wind energy in cities.

To qualitative and quantitative predict wind turbine performance in urban areas, CFD simulation is performed on real-life urban geometry and wind velocity profiles are evaluated. Two geometries in Arizona is selected in this thesis to demonstrate the influence of building heights; one of the simulation models, the ASU campus, is relatively low rise and without significant tall buildings; the other model, the downtown phoenix model on the other hand, are high-rise and with greater building height difference. The content of this thesis focuses on using RANS computational fluid dynamics approach to simulate wind acceleration phenomenon in two complex geometries, ASU campus and Phoenix downtown model. Additionally, acceleration ratio and locations are predicted, the results are then used to calculate the best location for small wind turbine installments.

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