

HUGE 3-D LATTICE STRUCTURE WITH SMALL WIND TURBINES FOR AMENITY SPACE

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In order to explore the new application concept of huge 3-d lattice structure with small wind turbines, three-dimensional numerical simulations of flow over two types of measurement features i.e. standalone and 5x5 array basic unit are investigated. The results are compared with experimental data and explain the relationships between deficit effects and the structure of windbreak. Results indicate that the horizontal extent of windbreak effects downwind found $3h$ where velocity reduction coefficient was found 0.6. Reductions of 20% or more may extend to about $7h$ from the windbreak. The results are stimulating and useful for design

In order to explore the new application concept of huge 3-d lattice structure with small wind turbines that will be consistent with the current political scheme globally, a friendly and multi-purpose wind turbine and its integration system have been developed. This small wind turbine system is characterized by its compactness, portability, simple structure and almost free from maintenance nature and could be accessible to various integrated system. The integrated system will be used for not only power generation but also wind breaking or flow control. Here, the integration concept means arrays of wind turbine and will be composed from hundreds to several thousands windmill. The integrated system has sited in several location as a practical test. For example, a multi-row agriculture windbreak was sited in Aomori prefecture, Japan to evaluate the windbreak effect in the agriculture field. The temporal result was presented in the paper. Successively, the preliminary examination was carried out experimentally and numerically for the optimal design. The prediction of the wind flow is important to evaluate the windbreak deficit effect on the fluid (air). Although the influence of a traditional windbreak on the reduction of wind speed is fairly well known, it is still yet been done how these influence will be behave with arrays of wind turbines. In the present article, three-dimensional numerical simulations of flow over two types of measurement features i.e. standalone and 5x5 array basic unit, are carried out. The Navier-Stokes equations, which were modified to include drag terms as a source term, have been solved using SIMPLE method and standard two-equation k - ϵ turbulence model. The approaching wind was simulated by power-law model to approximate the mean velocity profile. The velocity profile and the turbulence behind the array were measured and studied at different streamwise locations in detail. The accuracy of these simulations is examined by comparing with experimental data and explains the relationships between deficit effects and the structure of windbreak. Results indicate that the horizontal extent of windbreak effects downwind found $3h$ (h =windbreak height) where velocity reduction coefficient was found approximately 0.6. Reductions of 20% or more may extend to about $7h$ from the windbreak. In addition, it is confirmed that the constant and linear ratio zone of wake deficit exists in the far downstream. The results are stimulating and useful for design of wind control.