Abstract

The work deals with the development of a numerical code to study flow over prismatic buildings in tandem arrangement by means of Large Eddy Simulations (LES). Flow over two and three buildings in succession with different spacing and height have been considered in this study. Two dimensional unsteady Navier-Stokes equations have been solved using LES turbulence model. In LES, the contribution of the large-scale structures to momentum and energy transfer is computed exactly and the effect of the smallest scales of turbulence is modeled. Since the small scales are more homogeneous and universal and less effected by the boundary conditions than the large eddies, the modeling effort is less and presumably more accurate. Streamline plots, surface pressure distribution (Cp) and normalized velocity profiles have been obtained. Drag co-efficient and lift co-efficient of the buildings have been evaluated by integrating Cp distribution on the surface of the buildings. Two dimensional experimental surface pressure distribution on the buildings have been obtained by conducting experiments in the 2.5m×1.5m test section industrial wind tunnel facility available in the department and compared with the predicted Cp values obtained by using the present LES Code.

The results show that the building height and separation distance have significant effects on the flow characteristics on two or three buildings placed in tandem as compared with single building due to flow interference among the buildings. In addition the flow field characteristics depend on the relative position of short and tall buildings w.r.t wind flow.

Key Words: Wind engineering, CFD application, Large Eddy Simulation (LES), Incompressible, Stream function, Vorticity, Discretisation, Separation, Reattachment, Eddy viscosity, Subgrid scale, Recirculation, Windward, Leeward, Tandem arrangement, Interference, Vortex, Free-stream, Wind loads, Numerical Simulation, Spacing, Lift co-efficient, Drag co-efficient, Grid stretching, Clustering parameter, Solid blockage correction, Wake blockage correction.