Effect of Corner Modifications on Wind Pressure Characteristics of High-rise Buildings

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Summary

Pressures on a standard high building CAARC and other two same-sized buildings but with chamfered corners and rounded corners are numerical simulated based on the CFD (computational fluid dynamics) software FLUENT. By comparing with the results of the CAARC building from a wind tunnel test, the numerical results are proved to be in good agreements with experimental results. In contrast to the building with sharp corners, the shear layers separated from the chamfered and rounded corners approach the side surface, thus decreasing the drag force due to the reduction of wake width. It is recognized that the flow patterns around the buildings with sharp corners and chamfered corners are a type of complete separation in turbulent flow. While because the round-cornered building is more streamline in turbulent flow, smaller vortex size and thinner wake width decrease the wind pressure on leeward face remarkably. It is concluded that small chamfered corners and rounded corners are very effective to prevent aeroelastic instability for a rectangular building. Among the sharp, chamfered and rounded corners, the corner roundness is the most effective one to decrease the wind pressures.

Keywords: High-Rise Building; Computational Fluid Dynamics; Wind Loads; corner modification.

1. Introduction

With increasing height of the buildings, the wind velocity and turbulence are much larger. Furthermore, because of the bluff body of the buildings in the flow, the separation and vortex shedding enlarge the wind load on the building envelopes, which are more dangerous. Thus the reduction and control of wind loads is of great importance to high-rise buildings.

The application of aerodynamic measures on high-rise buildings to control wind loading is widely used, involving corner modification and height modification. Corner modification changes the shape of cross-section to reduce wind loads, including corner cut, recess, chamfer and so on. Researches on the effectiveness of corner modifications in reducing wind loads have been conducted. Tamura et al. [1] conducted wind tunnel tests on a square sectioned cylinder with sharp, chamfered and

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