The Effects of rooftop wind of an interference building to principal building

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- Purpose

The flow over top in square cylinder of high-rise building is investigated through interference effect in this research. Wind tunnel test (at Yokohama National University) and LES simulation (Octopus supercomputer supported by Cypermedia Center, Osaka University) are conducted for validation method. This research aims to find the the specific area of danger on cladding due to the rooftop wind. The distribution graph which show the relationship of position and wind pressure interference factor is built to have general view. In addition, a propose schemes of simulation and explanation of the reverse flow at top is provided to get close to wind tunnel results. Finally, the motion depend forces on principal building is explored through the elastic model

- Outline

Two square cylinder models with flat roof top are placed in tandem and oblique positions. The reverse flow on the top of high-rise building is considered as the most complicated wind phenomenon. Taniike (1992) mentioned that the principal building received more angular momentum which was generated from the shed vortices of upstream building. In research of Kawai, Okuda et al. (2012), the unsteady rooftop wind generates the arch-type vortex which stretches in a stream-wise direction near the tip of the vortex. Wind tunnel test and simulation results would give the best and valuable explanation on interference effects between two building.

- Results

The verification test has been test with RANS and LES method via AIJ Benchmarks for Validation of CFD simulations. The results have shown that RANS could not reproduce reverse flow on the roof. In the other hand, LES could give the correct reattachment length in downstream leading to the valuable key in interference research. The initial results were produced base on the inflow boundary condition in Yokohama city. Fig.1 shows the proof that the stretched vortices on roof could attack the principal building. And, by different location of interference building in tandem arrangement, the pressure on principal building even more danger compared to isolated case.
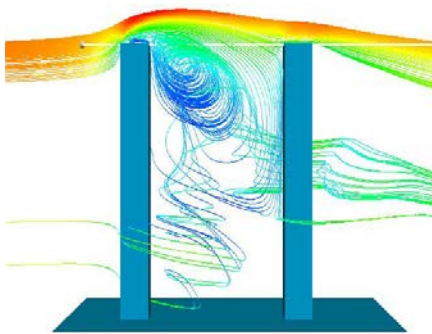

Fig.1: The vortices are generated from the roof of interference building
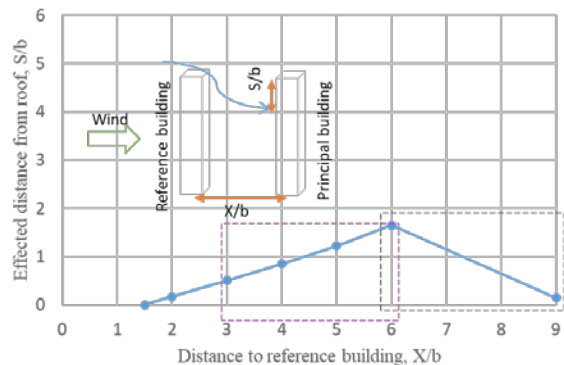

Fig.2: The effected distance near roof due to roof top wind

Interference model in tandem arrangement with distance from 1.5b – 6b, the effected distance from roof top is linear form as shown in fig.2. However, in distance 9b, the effect is likely ignored and act like individual model. These results are fixed well with the divided region suggested by Zdravkovich, M, 1985.

- Computing system: OCTOPUS (General Purpose CPU nodes)

  Node-hour: 576 node-hour (1 case)

  Used disk: 600Gb

  Parallelize: 16 nodes (384 CPU)