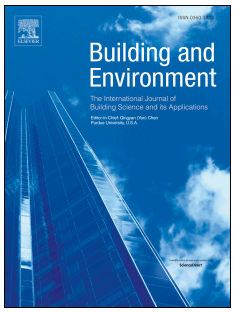
Accepted Manuscript



Application of a multi-variable optimization method to determine lift-up design for optimum wind comfort

Yaxing Du, Cheuk Ming Mak, Yantong Li

PII: S0360-1323(18)30018-0

DOI: 10.1016/j.buildenv.2018.01.012

Reference: BAE 5248

To appear in: *Building and Environment*

Received Date: 14 November 2017

Revised Date: 4 January 2018

Accepted Date: 5 January 2018

Please cite this article as: Du Y, Mak CM, Li Y, Application of a multi-variable optimization method to determine lift-up design for optimum wind comfort, *Building and Environment* (2018), doi: 10.1016/j.buildenv.2018.01.012.

Application of a multi-variable optimization method to determine lift-up design for optimum wind comfort

Yaxing Du[a], Cheuk Ming Mak[a]*, Yantong Li[b]

[a]*Department of Building Services Engineering, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong*
[b]*Department of Architecture and Civil Engineering, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong*

[*]*Corresponding author email: cheuk-ming.mak@polyu.edu.hk*

Abstract

The lift-up building design has been demonstrated to provide favorable wind comfort, but there is a lack of investigation on optimum wind comfort condition. This study coupled computational fluid dynamics (CFD) technique and response surface methodology (RSM) to determine the most desirable wind comfort around an isolated building with lift-up design. A multi-variable optimization method is proposed to determine optimum wind comfort and the corresponding lift-up design variables, namely, lift-up height (H_L), core aspect ratio(AR) and core number (N). To better illustrate wind comfort around the building, the wind comfort in the lift-up area and the podium area are investigated separately. The Detached Eddy Simulation (DES) approach is employed throughout the whole CFD simulation process. The quality and goodness of the established RSM models are examined by analysis of variance and genetic algorithm is applied to generate optimal design solution. The generated results illustrate good performance of the established RSM model. Results show that the optimum wind comfort is obtained when H_L is 8m, AR is 10%, and N is 6. The lift-up core aspect ratio is subsequently found to have greatest effect on wind comfort among the three design variables in both the lift-up area and the podium area. In addition, the proposed method is applicable to other similar environmental design conditions and the outcomes of study can also be of great value in the improvement of wind comfort in compact urban cities.

Keywords: *Lift-up design; wind comfort; computational fluid dynamics (CFD); response surface methodology (RSM); multi-variable optimization method.*