Numerical Simulation on Wind Pressure Distribution of Tensile Membrane Structures

SUN Xiaoying[1], GAO YONGSHENG[2] and WU YUE[3]

[1] Harbin Institute of Technology email: sxy_hit@163.com
[2] Harbin Institute of Technology email: gaoys@hit.edu.cn
[3] Harbin Institute of Technology email: wuyue_2000@163.com

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Tensile membrane structure is a new kind of long span structure, which is developed in the twentieth century and widely used in recent years in large scale stadiums, international exhibition centers and so on. It is characterized by lightness, flexibility and small-damping, so wind load plays a main role during structure design.

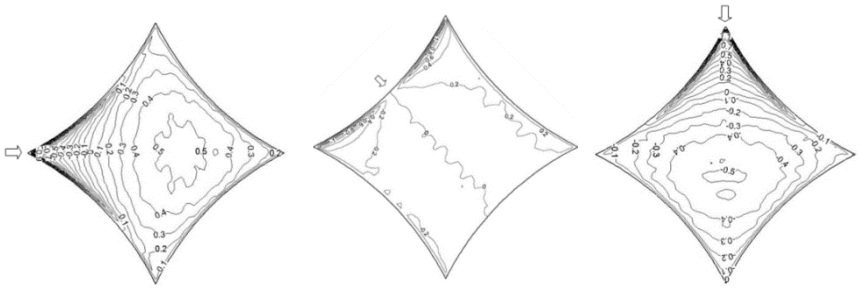
In this paper the numerical simulation for mean wind pressure distribution on typical tensile membrane structures is presented as Fig.1

(a) saddle shape (b) conical shape (c) wave-shape (d) arch-supported shape

Fig.1 typical tensile membrane structures

The numerical simulation is performed based on Reynolds-averaged Navier–Stokes (RANS), in which k-kl-ω turbulence model has been used. The computational method is based on a pressure correction algorithm of the SIMPLEC-type. Compared with corresponding wind tunnel tests, the computational results have good agreement with the experimental data. It is proved that the results are creditable and the method is feasible.

Then comprehensive simulation and analysis on the four kinds of typical shape are performed using the computational method above. The characteristics of wind pressure distribution are analyzed by considering some parameters such as wind direction, rise-span ratios, span-depth ratios and structural span. In Fig.2, the wind pressure distribution of the saddle shaped roof is showed.



0° 45° 90°

Fig.2 wind pressure distribution of the saddle shaped roof in different wind directions

At last, the roof is divided into some sub-regions whose wind pressure coefficient is provided according to the roof shape and the regularity of wind pressure distribution. Then,the mean wind pressure coefficients of roof region is provided.

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