学术论文

大跨屋盖结构多目标等效静风荷载分析方法

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摘要：

针对大跨屋盖结构多振型参与风振的特点，提出一种多目标等效静风荷载确定方法。其基本思想是，分别建立多目标等效方程组和约束方程组，前者可获得与各等效目标吻合程度最好的解，后者是根据风荷载作用方向为垂直于建筑物表面的钝体空气动力学原理得到的风荷载各方向分量的关系，限制某些奇异荷载作用模式的出现，从而解决了大跨屋盖结构等效静风荷载研究中突出存在的多目标等效问题。结合两个典型大跨屋盖结构的风洞试验，对不同类型的结构响应进行了等效静风荷载分析，并将分析结果与采用单目标方法所得的结果进行对比，结果表明该方法得到的等效静风荷载作用下各类响应均与动力极值响应吻合良好，达到了以少量的等效静风荷载模式实现所有目标等效的目的，并且所得等效静风荷载分布较符合实际风荷载作用规律。

关键词： 大跨屋盖结构　多目标等效方程组　约束方程组　多目标等效静风荷载

Multi-objective equivalent static wind loads for large span roofs

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Abstract:

The determination of equivalent static wind loads (ESWL) for large span roofs is a difficult problem in theoretical research of structural wind engineering. According to the characteristics of spatial structures, a new method was proposed to obtain ESWL for multiple equivalent objectives. First, a multi-objective equivalent equation was proposed to make the ESWL capture the maximum load effects of structure at the same time. Then a constraint equation related to the direction of wind loads was constructed in order to reduce the dimension of ESWL vector and to exclude some unrealistic and curious load distributions. At last, the method was applied to two typical large span roofs combined with wind tunnel tests. The results show that the maximum load effects captured by the ESWL agree well with those directly estimated by frequency domain response analysis. As a result, only few ESWL with clear physical meaning are needed to obtain all responses with sufficient accuracy.

Keywords: large span roofs　multi-objective equivalent equations　constraint equations　multi-objective ESWL

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