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学术论文

台北101大楼风致响应实测及分析

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摘要： 台北101大楼主塔楼总高508m共101层,在台风"马莎"和"泰利"影响下,对其风致响应实测资料进行统计分析,评估了典型超高层建筑的风致振动特性。结果表明两次测试的结构模态参数基本吻合,有限元分析的自振频率小于实测结果,计算的振型与测试结果符合较好,利用随机减量方法识别的结构阻尼比与振幅之间呈现非线性关系,并不同程度的表现出随振幅增大而增大的特性,实测的结构一阶阻尼比大于同类超高层建筑物的测试结果,两次台风作用下89层、101层的加速度峰值和均方根均小于规范相应限值,满足舒适度的要求。测试结果为超高层建筑设计及相关研究提供有用的资料及依据。

关键词： 超高层建筑 原型实测 风致响应 阻尼比 自振频率 舒适度

Full-scale measurements and analysis of wind-induced response of Taipei 101 Tower

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Abstract: Taipei 101 Tower has a height of 508m and 101 storeys.Statistics analysis of wind-induced response data measured from Taipei 101 Tower during the passage of Typhoons Masta and Talim were conducted.The characteristics of wind-induced vibrations of the super tall building under typhoon conditions were investigated from the measured acceleration data.The measured results revealed that the structural modal parameters which obtained from a direct analysis of the acceleration data during the two typhoons are similar.The measured natural frequencies of the Taipei 101 Tower are larger than those from the numerical analysis.The measured mode shapes are in good agreement with those calculated from the computational model of the building.The damping curves determined using the random decrement technique based on the field data during the typhoons clearly demonstrate nonlinear energy dissipation characteristics.It is also shown that the damping ratio generally increase with increase in vibration amplitude during the typhoon.The measured damping ratios of the first modes in two orthogonal directions are larger than those measured from super tall buildings with similar structural systems.The peak and RMS acceleration responses measured from the 89th and 101st floor of the building during the two typhoons were all below the serviceability criterion stipulated in relevant wind-resistant design codes for occupancy comfort and it can be concluded that the Taipei 101 Tower would appear to satisfactorily meet the occupancy comfort criterion under moderate wind conditions.The presented results in this paper are valuable for the design of super tall buildings.

Keywords: full-scale measurements wind-induced responses damping ratios natural frequencies occupancy comfort

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