The 2024 World Congress on
Advances in Civil, Environmental, & Materials Research (ACEM24)
19-22, August, 2024, The K hotel, Seoul, Korea

Research on wind load drag coefficient identification of transmission tower considering rotational degree of freedom

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ABSTRACT

The drag coefficient is an important parameter in the wind-resistant design of the transmission tower structure. However, the values in the current specifications refer to the wind tunnel test and numerical simulation results, and the field measurement is difficult. Moreover, the classical wind load identification method does not consider the influence of rotation, resulting in inaccurate identification results of the drag coefficient. This paper proposes a wind load reconstruction method considering rotational degrees of freedom, and then a drag coefficient identification method is established based on the measured wind speed data, which solves the problem of accurately obtaining the drag coefficient of transmission tower structure from the perspective of field measurement. Firstly, the dynamic displacement is calculated from the acceleration and strain data, and then the structure is simplified into a condensation model. The mass matrix including the influence of rotational degree of freedom is established and the wind load is reconstructed. Finally, the drag coefficient is calculated by combining the wind speed data. The proposed method is verified by numerical simulation, and the results show that the maximum reconstruction error of the drag coefficient is only 4.1 %. During the typhoon landing in Mangkhut, the applicability of the proposed method to the actual structure is further verified by the monitoring data collected on a transmission tower. The comparison between the reconstructed drag coefficient and the standard value shows that the drag coefficient decreases with the increase of wind speed, and the measured value of the drag coefficient at high wind speed is obviously smaller than the standard value.