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Dynamic Wind Resistance Reliability of Long-Span Spatial Structures Based on Wind Tunnel Tests

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ABSTRACT

Four identical long-span spatial structures in a rectangular array are tested in the wind tunnel to determine dynamic wind loads on structures. Based on the time-history data of spatially distributed wind pressure, wind-induced vibration analyses of the structures under varying incident wind angles have been carried out in time-domain. Then a novel framework of dynamic wind resistance reliability assessment has been proposed by integrating Monte Carlo method and the non-Gaussian wind pressure field simulation method. The framework takes into account the uncertainties of design wind speed, wind direction angle and structural damping ratio, as well as the randomness of wind pressure field. It has been demonstrated that the proposed framework is effective and efficiency to comprehensively assess dynamic wind resistance reliability of long-span spatial structures. The results show that the failure probability of the long-span spatial structure under 50-year return period wind is about 0.0578%.

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