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Damping characteristics of aluminum alloy cylindrical latticed shell

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Abstract

In order to give a specific damping ratio value of aluminum alloy latticed shells, the field measurement was carried out on an aluminum alloy cylindrical latticed shell with a planar dimension of 40m×36m and a height of 3.9m. A total number of 19 kinds of load cases were designed. Subsequently, 380 damped free vibration acceleration responses of the joints were collected. Then using analytical modal decomposition (AMD) and Hilbert transform, the natural frequency and modal damping ratio of the structure can be obtained. Based on the statistical analysis of the obtained data, the damping ratio for such aluminum alloy cylindrical latticed shells was suggested as 4%. Besides, a finite element model of the measured structure was established using the suggested damping ratio. And the nodal dynamic responses given by numerical analysis show good consistency with test results. Consequently, the damping ratio given in the paper could be applied in dynamic response analysis and engineering design of cylindrical latticed shells with aluminum alloy gusset (AAG) joints.

Keywords: cylindrical latticed shell, aluminum alloy gusset joints, analytical modal decomposition, modal identification, damping ratio.