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Abstract

WIND-INDUCED RANDOM VIBRATION ANALYSIS OF THE CABLE-STAYED BRIDGE WITH FINITE STRIP ELEMENTS

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The aim of this research is to analyze the random vibration of cable-stayed bridge caused by the Turbulence force of wind. For free vibration analysis, the numerical results are compared with test results. Good agreement is obtained. Finally the power spectral density and correlation functions for the displacements are obtained.

This investigation provides a foundation for further research and structural reliability analysis of the cabled-stayed bridge excited by wind. The turbulent force configured at 0° angle of attack is applied on the cable-stayed bridge. The frequency domain method is used for response analysis in this investigation. The superposition of the normal modes is utilized. The nonlinear effect is not taken into account. The power spectra for the wind force and moment are considered with the spatial correlation of the wind velocity along the bridge span.

Box girder bridges are considered in this thesis since they are very popular for highways because of their high torsion rigidity, good appearance and wind force reduction function. However, the structural analysis of box girder bridges is difficult because of their complex deformation pattern and stress distribution, especially if the structure is continuous with intermediate supports and includes unsupported stiffening diaphragms. Although both finite strip method and finite element method can be employed to analyze such bridges, the analysis cost is greater for the latter. In this research, the compound element has been used in the analysis, the flat shell strip from finite strip method is used to model the deck of the cable-stayed bridge, 3D-beam element and 3D-rod element from finite element method to model the pylon and cable, respectively.