Influence of cable systems in statics and dynamics of cable-stayed bridge

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Abstrak

ABSTRACT
The present study deals with the static and dynamic behavior of cable-systems and cable-stayed bridge systems. In the static analysis, linear. and geometry nonlinearities such as large-deflections and stress-stiffening are evaluated. In the dynamic analysis, only linear: analysis is taken into account, the nonlinearities are disregarded.

In the cable system, there are two cable models evaluated, i.e., the horizontal cable-systems and inclined cable-systems. The cable systems are modeled as three-dimensional (3-D) structural system. The various prestressed forces in the cables are investigated, and the results show that the nonlinearity effects do not quite have an influence when the prestressed forces are between 21% - 45% fp. and 15% - 45% fpU for the horizontal cable and inclined cable-systems, respectively. The transverse (coupling effect) stiffnesses are nearly zero for the prestressed forces in the cable between 16% - 45% Cu. The dynamic characteristic of both cable-systems are quite similar, with the first mode is out-of-plane motion. The gravity acceleration does not take an important influence in the dynamic behavior of the cable-systems study herein.

In the cable-stayed bridge systems, two common types of cable-stayed bridge are investigated, namely the fan-type and the harp-type cable-stayed bridge. The bridges are modeled as two-dimensional (2-D) structural system. The comparison results of axial forces in the cables, vertical displacement in the mid-point of middle span, horizontal displacement at top of pylon, bending moment in the deck, axial forces in the deck and also vertical reaction at foundation of pylon are all investigated. The results show that the nonlinearity effects with the prestressed forces in stay cable between 16% - 45% fp? seem do not have quite important influence. The natural frequencies and mode shapes for the first 20 modes are presented and the results are quite similar for the both bridge systems. The influence of dead load multiplier to the dynamic characteristic of such bridges are also evaluated and the results show that the structure buckle under 19 DL (Dead Load) and 15 DL for the fan and harp-type, respectively. These results show that bridge models studied herein are in the safe design consideration.