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THE DYNAMIC OF CABLE STAYED BRIDGES WITH A TIME PERIODIC DAMPING COEFFICIENT

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Abstract

In this paper a rain-wind induced vibrations of a simple one degree of freedom system related to the dynamics of cable-stayed bridges will be studied. Usually the stay cables have a smooth polyurethane mantle and a cross section which is nearly circular. Under normal conditions for such type of cables one would not expect galloping type of vibrations due to wind-forces. There is an exception concerns vibrations excited by a wind-field containing raindrops. As has been observed on scale models in wind-tunnels the raindrops that hit the inclined stay cable generate one or more rivulets on the surface of the cable. The presence of owing water on the cable changes the cross section of the cable as experienced by the wind field. Accordingly the pressure distribution on the cable with respect to the direction of the (uniform) wind flow may become asymmetric, resulting in a lift force perpendicular to direction of the wind velocity. During the motion of the cable the position of rivulet(s) may vary as the motion of the cable induces an additional varying aerodynamic force perpendicular to the direction of the wind field. The idea to model this problem is to consider a horizontal cylinder supported by springs in such a way that only one degree of freedom, i.e. vertical vibration is possible. It will be studied a ridge on the surface of the cylinder parallel to the axis of the cylinder. Additionally, let the cylinder with ridge be able to oscillate, with small amplitude, around the axis such that the oscillations are excited by an external force.

Key Words and Phrases : Flow induced vibrations, Stability diagrams, Periodic solutions.

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