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A New Model for the Study of Rain–Wind Induced Vibration

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Inclined stay cables of bridges are fixed on one end to a pylon and on the other end to the bridge-deck. Usually the stay cables have a polyurethane mantle and a cross section which is nearly circular. With low structural damping of the bridge, a wind-field containing raindrops may induce vibrations of the cables.In this paper model equations are presented for the study of rain-wind induced vibrations of a simple oscillator and a rod of circular crosssection. As will be shown the presence of raindrops in the wind-field may have an essential influence on the dynamic stability of the cable. In this model equation the influence of the variation of the mass of the cable due to an incoming flow of raindrops hitting the structure and a mass flow which is blown and shaken off, is investigated.The time-varying mass is modeled by a time harmonic function whereas simultaneously also time-varying lift and drag forces are considered.From a practical point of view one may conclude that in order to avoid instabilities one should design the oscillator in such a way that rain water accumulation and variation should not be possible.

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