

USING PERTURBATION METHODS TO IDENTIFY PERIODIC SOLUTIONS IN MASS-SPRING SYSTEM WHEN PERTURBED BY A WIND FORCE

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ABSTRACT

Small perturbations in wind forces on a structure such as an airplane, a building, a bridge-cable, and so on, can induce large oscillations in the structure. Furthermore, these structures usually can be modelled as mass-spring systems.

The first step in this research is to make mathematical models of mass-spring structures which are perturbed by wind-forces. Secondly, identifying the existence of limit cycles or periodic solutions in the model equations. Because the model equations can be categorized as perturbation problems, perturbation methods (such as the averaging method, the multiple time-scales perturbation method, and so on) can be used to find limit cycles and periodic solutions. Thirdly, after found the limit cycles and periodic solutions, we will determine the stability of the limit cycles and the periodic solutions.

The stability of the limit cycles and periodic solutions can be used to predict whether the structure will vibrate with big amplitudes or not. One of the benefits of this research is that the simple models of mass-spring systems can be used to simulate the effect of wind forces on the structure of an airplane, a bridge-cable or beam.

Kata Kunci: *perturbations*