

STUDY LARGE DEFORMATION COIL SPRING DEVELOPMENT FOR ROBOTICS SUBMERSIBLE

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Abstract

In this work the present a theoretical study for the free vibration of cylindrical, conical and helical springs. Circular cross sections, and non-circular cross section, namely elliptical, are considered as well for the investigating of the frequency characteristics of the springs. The equations of motion are derived mathematically for springs with different geometries. The mode shapes are numerically implemented by using COMSOL 4.2 software package for three dimensional solid elements. The mode shapes configurations are determined by applying different force loads and boundary conditions for different number of spring turns. The results show that increasing the number of turns leads to decrease the spring stiffness and vice versa. Also decreasing turn number is a good strategy to distinguish between different mode shapes. Springs stiffness is directly proportional to coil diameter. It is also shown that the configuration of cylindrical- elliptical spring is prone to the applied force where the stiffness is lower among all other spring types with the same number of turns.

Keyword : free vibration , helical springs , non-cylindrical