THE CALCULATION OF THE NATURAL FREQUENCIES OF TUBULAR MANOMETRIC SPRINGS

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Wound tubular springs used to measure high pressures are the most common sensing element of thermal and manometric instruments in aviation. Manometric tubular springs often operate in vibration (oscillatory motion), which adversely affects the accuracy of measurements of such devices. An important characteristic of devices' vibration is the frequency of natural vibrations of tubular springs, so it is necessary to determine the effect of geometric dimensions on this parameter. Most of the designs of manometric springs with increased vibration resistance have a variable cross-section along the length of the tube.

In this study, we propose a method for calculating the natural vibration frequencies for springs that look like a curved rod with a variable cross-section, oscillating in the plane of curvature of the central axis. On the basis of this method, an algorithm and a computer program with which the calculations of natural oscillation frequencies are carried out.

According to the results of calculations, the graphs of natural oscillation frequencies against the geometric parameters of tubular springs (the bending radius of the tube, thickness of the tube wall, rotation angle and the ratio of semiaxes of the elliptical tube preform**)** were built**.** It was found that for springs with variable length cross-section, reducing the thickness of the tube wall from the fixed end to the free, as well as reducing the radius of the tube-workpiece from the fixed end to the free leads to an increase in the frequency of natural oscillations.

Comparison of the manometric springs of various designs showed that the highest natural frequency oscillation have the springs, cross sections of which vary from three-leaved (in fixing point) to plane-oval (at free end). The natural frequency of tubular springs of variable cross-section along the length is 15–30% higher than the natural frequencies of oscillations of springs of conventional structures.