

GYROPLANE ROTORS VIBRATION TESTS

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Abstract

The article presents vibration test of three different types of gyroplane main rotors. The test was carried out on a specially prepared test bench using a Red Led Tacho Sensor measuring system. Tests were conducted for the project „Research and development works on innovative construction of aircrafts of weight over 560 kilograms at the company Trendak Aviation”. The work outlines the basic properties of the gyroplane vibration and gives their sources. The research focused on the gyroplane main rotor vibration related inter alia to the rotor imbalance as well as rotor hub connector construction. Tested rotors consisted of three different types of gyroplane rotor blades and innovative universal hub connector with positive coning angle of 2.8°. The article summarized the basic properties of three types of gyroplane the rotor blade, marks advantages of use hub connector witch constructional dihedral angle. Discusses the principle of operation of measuring device, tests methodology starting from instrument calibration. The results of the measurements are shown in the graphs in polar coordinates. The vibration measurement is carried out in two axes, in x-axis, longitudinal, along the rotor radius and in y-axis, perpendicular to the x-axis, in the direction of the chord of the rotor blades.

Keywords: rotor vibration, rotor blades, teetering rotor, hub connector, rotor imbalance

1. Introduction

In rotorcrafts design the vibration phenomenon is crucial. As a result of machine elements vibration harmful interference in the proper functioning of rotorcrafts appears. Vibrations have adverse effect on the strength and durability of rotorcraft; also have bad influence on their operator and excessive noise generation [4]. The control of vibration is important for four main reason:

- to improve crew efficiency and hence safety operation,
- to improve the comfort of passengers,
- to improve the reliability of avionic and mechanical equipment,
- to improve the fatigue lives of airframe structural components [1].

Gyroplanes unlike helicopters because of the simple construction have fewer sources of vibrations affecting the whole machine. No auxiliary rotor means no vibration source at the end of the fuselage. Gyroplane pusher propeller or rarely, tractor propeller is a source of high-frequency vibrations. A significant source of gyroplane vibration is its control surfaces. In the case control surfaces are operated in the propeller stream, it means a strong turbulence effect, and thus a low frequency surface vibration [5].