



INFLUENCE OF TORQUE VARIATION ON TIMING BELT DRIVE'S LOAD DISTRIBUTION

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Abstract: In this paper was made a numerical analysis of timing belt drives. The subject of analysis in this paper is influence transitions of torque on distribution loads of the timing belt drives. For calculating the elements in this paper, timing belts and pulleys, with variable torque values was applied Finite Elements Analysis (FEA). Timing belt drive is exposed to different values of torque, and results indicate how the stresses change in working conditions of drives. Analysis was conducted for real timing belt drive. The analysis is performed using software package Autodesk Inventor Professional.

Key words: Timing belt drives, Finite Element Analysis, torque, simulation, stress

1. INTRODUCTION

The timing belt drives was a relatively new conception for the power and motion transmission. Timing belt is widely used for transmission power and movements on vehicles. The main task of timing belt drives is transmitting of power and motion from driving on driven shaft.

The power transmission from driving on driven pulley is performed by direct contact belt teeth with the belt pulley teeth. The first timing belt was constructed in 1946 by Richard Case. Timing belt's construction is made so the belt groove is in the contact with apex surface of the belt. Due to transmission torque comes to the sliding of teeth across the teeth of pulley, there are frictional forces, but appearance of friction in timing belt drives and it's consequences have not been sufficiently investigated [1,2]. It would be perfect if all the teeth in contact of timing belt pulley had the same loading, but the teeth loading values of the belt depend on the maximal torque and the teeth position on angle of pulley as well, but those conditions are almost impossible to reach.

The published papers on the theme of the analysis of the loads distribution in timing belt drives, give loads variations only in static conditions, respectively with invariable torque.

Models for the loads investigation in static conditions are from 1978 year, when Gerbert and Jönson independently developed model of timing belt drive with trapezoidal profile of teeth [3].

The first analysis of load distribution in timing belts with Finite Element Analysis (FEA) gave Kido 1992 [4] year, and in the next period this method is more introduced in analysis of timing belt drives [5]. In order to reduce time and calculations in numerical analysis, timing belts and pulleys are models in two dimensional environment.

2. KINEMATICS OF THE TIMING BELT DRIVES

Load distribution of timing belt drives affects the working ability and the drives life. Considering the large number of parameters which affects on torque transmission, kinematic analysis of the coupling is extremely important, but also extremely complex process. In this paper is given a motion analysis of timing belt drives, when timing belt with pulley has a trapezoidal profile of teeth.

At the beginning of the coupling between timing belt with driving pulley, belt tooth strain is maximum due to preload force. At the beginning of the coupling, the tooth top has contact with broadside surface of pulley and in that moment happens the contact per line. Due to interference, the tooth belt encroaches on the broadside surface of the belt pulley.

The timing belt pulley has a much greater stiffness than the timing belt, and then happens the belt deformation in the coupling. The process of the entering teeth belts and pulleys in the coupling was given on Figure 1.

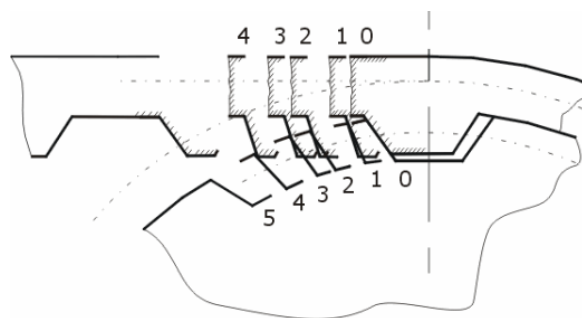


Fig. 1. Tooth belt and pulley in the coupling

