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DYNAMIC BEHAVIOUR OF C CONCEPT PLANETARY REDUCER

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Abstract: *Appearance of vibrations has a negative influence on planetary reducer operation. Vibrations which appear at the start have the worst effect. Determination of the mechanism of vibration and their reduction to an acceptable level, are issues for a lot of modern research related to planetary reducers.*
Presented in this paper is a new design solution of a planetary C concept reducer. According to known dynamic models, for this particular reducer, an original dynamic model is developed. The original dynamic model describes dynamic parameters of the presented reducer. At the end of the paper, a discussion is given, and guidelines for further research possibilities

Key words: *planetary gearbox, dynamic model, dynamic behaviour*

1. INTRODUCTION

Planetary gearboxes with their compact design are largely represented in operating systems of mobile machinery. Operating conditions for transmissions in mobile machinery vary within a wide range. Research of the gearbox dynamics in this case is of great importance. Examining the dynamics of planetary gearboxes leads to conclusions that could greatly assist the development of planetary reducers with regard to: improving their compact design, increasing reliability, increasing the lifetime of the drive, reducing vibration and reducing noise in working conditions, etc.
Due to the aforementioned reasons, a lot of research is done in the field of gearbox dynamics. Analysis of the dynamic behavior of planetary reducers is possible with various computer software, which perform simulations [1], [2], [3]. Computer simulation could be verified by experimental methods [4], [5]. An even greater impact on planetary drive research is given by the possibility of performing physical experiments to verify the computer simulated dynamic analyses.
In this paper a new concept of planetary drive has been developed. Its dynamic model has been made, which has been solved in *MATLAB - SIMULINK*, [6]. The results of the simulation are also presented in the paper. The paper also presents the conclusions drawn from the simulation, and possible directions for future research.

2. DYNAMIC MODEL OF NEW CONCEPT PLANETARY GEARBOX

Planetary gearbox of C conception has been developed in this paper. It consists of a pinion carrier (h), a stationary central ring gear (e), dual pinion (f - g) and the movable central ring gears (b), (Figure 1).The planetary gearbox in Figure 1 is designed for the parameters given in Table 1.

Table 1. Parameters for the design of planetary gearbox

Power	P_{in}	5 [kW]
Input rot. per min.	n_{in}	1200 [min^{-1}]
Transmission ratio	i_R	1:20

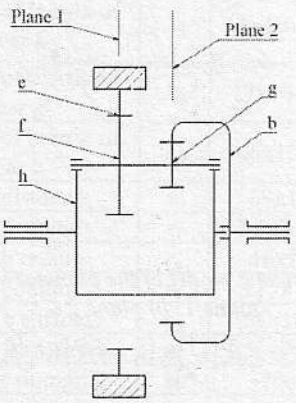

Fig. 1. Schematics of the developed planetary gearbox

2.1 Dynamic model setup

The dynamic model of the planetary reducer is set in such a way as to present the planetary reducer in two planes (Figure 1). Common elements to both planes are the pinion carrier (h), dual pinion (f - g) and the shaft that connects the dual pinion to the pinion carrier. The dynamic model has four degrees of freedom which defines the dynamic system of the planetary reducer: y_1 radial movement, the movement of the pinion carrier (h) around its axis Θ_h, moving dual pinion around its own axis Θ_f (it is equivalent to Θ_g, since it is a dual pinion setup) and moving of the portable central ring gear (b) around its axis Θ_b. The choice of the number of degrees of freedom best describes the operation of this planetary reducer. Contacts between gears which are coupled are