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Cinetostatic analysis of planetary precessional multiplier

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Abstract. The majority planetary precessional transmissions diagrams developed previously operate efficiently in reducer's regime. Teeth profiles have an important role in the efficient transformation of motion in the precessional transmissions that operate as multipliers. Multiple precessional gear theory, previously developed, did not take into consideration the influence of the diagram error of the linking mechanism in the processing device for gear wheel on the teeth profile. Functioning under the multiplication regime, the errors of the linking mechanism have major influence, which can lead to instant blocking of gear and to power losses. With this purpose, a thorough analysis was conducted on the motion development mechanism under multiplication, and on the teeth profile error generating source. This paper describes also the precessional transmission diagrams operate efficiently in multiplier's regime, and cinetostatic analysis of precessional multipliers.

1. Introduction

Depending on the structural diagram, precessional transmissions fall into two main types – *K-H-V* and *2K-H*, from which a wide range of constructive solutions with wide kinematical and functional options that operate in multiplier regime. The kinematical diagram of the precessional transmission *K-H-V* (fig. 1 [1]) comprises five basic elements: planet career *H*, satellite gear *g*, two central wheels *b* with the same number of teeth, controlling mechanism *W* and the body (frame). The roller rim of the satellite gear *g* gears internally with the sun wheels *b*, and their teeth generators cross in a point, so-called the centre of precession. The satellite gear *g* is mounted on the planet (wheel) career *H,* designed in the form of a sloped crank, which axis forms some angle with the central wheel axis θ.

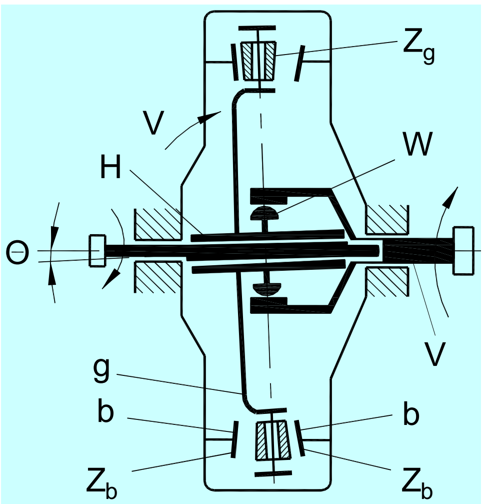

Figure 1. Conceptual diagrams of precesional transmissions that operates efficiently in the multiplication regime.

Revolving, the sloped crank *H* transmits sphero-spatial motion to the satellite wheel regarding the ball hinge installed in the centre of precession. For the transmission with the controlling mechanism designed as clutch coupling (fig.1.141, a), the gear ratio (gear reduction rate) varies in the limits:

$$i_{HV}^{g} = -\frac{z_g \cos\Theta - z_b}{z_b};\; i_{HV}^{g} = -\frac{z_g \cos\Theta - z_b}{z_b \cos\Theta}, \quad (1)$$

reaching the extreme values of 4 times for each revolution of the crank ***H***. If necessary, this shortcoming can be eliminated using as a controlling mechanism the constant Cardan joint (Hooke's joint), the ball synchronous couplings, etc.

$$i_{HVmed}^{g} = -\frac{z_g - z_b}{z_b}. \quad (2)$$