Dynamic model elaboration for the planetary-precessional gear reducer against vibration

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Abstract. The purpose of modern-day machines in general and gear-box in particular is to carry out needs-based on maintenance, good working conditions and to minimize the repair and other servicing downtimes and disfunctionalities. This increases the overall equipment effectiveness and optimizes the cost. The mechanical condition of a machine or a machine components can be accurately diagnosed from the nature and extend of vibration they generate. The aim is to detect damage as it occurs, allowing scheduled repairs or maintenance to be carried out in time.

1 Vibration generating sources in the planetary-precessional gear

Precessional transmission is a mechanical system subjected to mechanical oscillations, generating vibrations and noise, and can be divided into the following groups [1]:

a) Dimensional deviations of sliding contact elements;

b) Dimensional deviations in machine parts that make rolling contact;

c) Imbalance, when the center of mass of a rotating or precession element does not coincide with the center of rotation (or precession) [2];

d) Disassembly - deviation from the collinearity of the axles of the electric motor shaft, the precession reducer and the brake, deviation which occurs at normal operating temperature;

e) Vibration resulting from assembly errors [3].

2 The dynamic model of the planetary precessional reducer elastically bonded against forced vibrations

If we examine the dynamic model of the planetary precessional reducer, we conclude that the reducer is a rigid system with a vertical plane of symmetry. As with any other gear transmission, precessional planetary transmissions (later on the textPPT) are excited by various disturbing forces.

Figure 1 shows the 2D-simplified planetary 2K-H reducer simplified model. A summary analysis shows that, in general, the reducer consists of two cylinders with diameters D1, D2.

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