DYNAMIC CONSEQUENCES OF UNPARALLELISM OF AXES IN MECHANISMS WITH OSCILLATING FOLLOWER

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Abstract: *The paper illustrates that in the case of a mechanism with oscillating follower, not ensuring the parallelism between the cam and follower axes conducts to occurrence of shocks during mechanism's operation. The source of these shocks, in the case of unparallelism between the two axes, is the abrupt removal of contact point on the intersection curves between the lateral surfaces and the active surface of the cam. Using a fictive mechanism where the driving element is a shaft with three cams with suitable selected profiles, it is confirmed that at the transition of contact point from one curve to another, a shock is produced.*

Keywords: *oscillating follower, unparallel axes, shock*

1. Introduction

Optimum accuracy guarantee when constructing a mobile mechanical structure is a major task followed both during design phase and manufacturing and assembly phases. A handy solution would be prescribing very tight tolerances for all parts of the system. Though from functional point of view it is a good choice, from economic perspective is an unfortunate solution, as it increases substantially the cost of final product. It is noticed that prescribing the precision parameters has two opposite effects: a poor precision will conduct to low cost of price and low operational parameters while a high precision will determine a costly product but with better functional performances. The resulting conclusion is that there is an optimum precision ensuring balance between the two parameters: price of cost and functionality. Any mobile mechanical structure is based on a kinematical chain. The manner the precision is given for the parts and whole chain will definitely affect the operation of entire structure.

To illustrate the above affirmations, it is considered one of most frequent mechanisms, the four-bar linkage. Theoretically, this is a planar mechanism, family 3 . The mechanisms can be considered a planar one as long as the parallelism deviation between the axes of the mechanism doesn't exceed a certain value. When the parallelism deviation of axes is outside the tolerance zone the mechanisms is no longer a planar one and becomes spatial.

Establishing the degree of freedom or mobility of mechanism, under the assumption that now, the mechanism is of zero family, it results to be negative, $M = -2$ or the mechanism is overconstrained with immediate effect the impossibility of motion. The solution of the problem can be found in two manners: either by prescribing tighter tolerances or, as Dudita shows, [1], by structure optimization of mechanism, that, in this case, assumes replacing the intermediate revolute pairs with spherical joints.

2. The Effect of Parallelism Deviation in the Case of Oscillating Follower Mechanism

In the case of cam mechanisms with oscillating follower, Fig. 1, when unilateral cam-follower pair exists, the jam possibility is excluded.

With the hypothesis that the cam and follower axes are perfectly parallel, the