EXPANSION OF TECHNOLOGICAL OPPORTUNITIES OF LONGITUDINALLY MODIFIED TOOTH WHEELS PROCESSING BY THE ROLLING METHOD

Summary. The way of achievement of longitudinally modified tools is described at diagonal shaving without the use of special adaptations or attachments. The settlement dependencies for the definition of the corner of the crossing of preparation and diagonal submission axes are given which results in a longitudinal modification of tools.

Keywords: tool modification, diagonal submission, axes crossing

At present in mechanical engineering the following methods are found of cog-wheels processing – longitudinal, diagonal, short course. These methods differ in the direction of submission, processing periods, shaving design. At the tooth-shaving the longitudinal modification of teeth is provided by means of communication to the machine tool with the attached preparation vibrations [1]. The hardness of technological system which influences the quality and accuracy of processing [2] in this case is considerably reduced. With the purpose of exception of such phenomena the developed way at which in a starting position Fig. 1) the tool 2 and preparation 1 are established so that the centre of crossing of axes of the tool and preparation KP was placed behind an end face of preparation and with an end face of the tool. Initial debugging of the machine tool is carried out similarly to debugging for tooth-shaving cogwheels by the method of longitudinal submission (2). After installation of the centre of crossing of axes in the central part of the preparation and the tool, the preparation undergoes submission along its axis for length

\[ S_{np} = \frac{b_1}{2} - \left( \frac{b_0}{2} \right) \cos \sum_{1}^{1} 1 \pm 2.\text{мм} \] (1)
And the tangential submission

\[ S_T = \left( \frac{b_0}{2} \right) \sin \Sigma^1 \]  

(2)

where: \( b_1 \) and \( b_0 \) – width of gear wreaths of preparation and the tool, \( rr \),  
\( \Sigma^1 \) – the angle of the crossing of axes in the starting position, the hailstones.

As a result of the realization of such additional shift move from the centre of the crossing of axes the necessary starting position is reached During formation a barrel forms a tooth of preparation undergoing submission along its axis and additional submission normally occurs in preparations (diagonal submission). At the processing the greatest allowance survey occurs in points P that answer incision and an output shaving (Fig. 2,3). In point P the size of the left allowance decreases due to an increase at size. At the processing as a result of the change of inter-axial distance the corner of the crossing of the shaving axes and preparations in the starting position \( \Sigma \) differs from the settlement corner of crossing S, accepted at the known diagonal methods. The size of the corner \( S_1 \) is defined on the dependence:

\[ \Sigma^1 = \alpha \text{ctg} \left[ \text{tg} \Sigma \left( \frac{a}{a + \frac{\Delta S}{\sin \alpha_n}} \right) \right] \]  

(3)

where: \( \alpha \) – the inter-axial distance, mm;  
\( a \) – a normal corner of gearing, the hailstones;  
\( \Delta S \) – the necessary barrel size.

In the starting position shaving and preparations accept the corner of the crossing of axes equal to \( S_1 \), and preparations or the tool submissions \( S_{np} \) and \( ST \) (diagonal submission under the corner \( e \)) until the centre of the crossing of the shaving axes and preparation does not reach the centre of preparation (\( b_1/2 \)), and the corner of crossing will not reach settlement size S. After that a direction of tangential submission change on opposite. The corner of diagonal submission \( e \) is defined by the dependence:

\[ \text{tg} \ e = \frac{2a \arccos \left( \frac{a}{a + \frac{\Delta S}{\sin \alpha_n}} \right)}{b_1} \]  

(4)
At much through the tooth-shaving after the end of the next pass of shaving are established in the starting position, moving its longitudinal submission of preparation on size $S_{n_p}^1 = b_0 \cdot \cos \Sigma^1$ and tangential submission of preparation on size $S_T^1 = b_0 \cdot \sin \Sigma^1$.

Then preparations or the tool diagonal submission under a corner (in directions parallel to submissions of previous pass (3) occur. Such a way allows to process cogwheels with longitudinally modified tools by the diagonal method without the use of special adaptations or attachments. It results in an expansion of the technological opportunities of diagonal shaving. In the described way tooth-shaving can be realized on machine tools which provide two-store moving of a table to a horizontal plane. On a tooth-shaving machine tools without the second coordinate movement, in the described way it is possible to receive longitudinally modified tools in the conic form. Thus, the debugging of the machine tool does not differ from the above-considered ones.
Fig. 2. Change of interaxial distance at processing

Fig. 3. The circuit for the definition of the corner of the crossing of the preparation and the tool axes

REFERENCES


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