Design of Precision Finishing Method for Cold Extruded Sun Gear With Internal External Tooth Shapes

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Abstract

Due to the complex metal flow in the cold extrusion of sun gear, the teeth accuracy of formed sun gear is poor. In order to improve the accuracy of the extruded sun gear, a novel precision finishing method was proposed in this study. A new finite element (FE) prediction strategy was developed to obtain an in-depth understanding of the deviation distribution laws of the finished sun gear. Then, the forming laws of internal-external gears such as material flow, tooth deformation, forming load and tooth accuracy were analyzed using FE simulation and verified experiment. The investigation results show that the single deviations in profile and helix both first diminished remarkably, and then rose gradually while the single M value deviation decreased remarkably with increasing the tooth width. The simulation results of teeth deviations are well agreed with the experimental ones, which verifies the reliability of the FE prediction strategy. Moreover, the profile accuracy of external gear can be improved from ninth to seventh class, lead accuracy can be enhanced from tenth to eighth class, and total M value deviation of internal spline is reduced to 72.3 μm which proves the feasibility and effectiveness of the precision finishing method.

Full Text

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Cold extrusion process diagrams of sun gear: (a) extruding internal spline; (b) extruding external gear

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