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PII: S0924-0136(18)30105-5
DOI: https://doi.org/10.1016/j.jmatprotec.2018.03.006
Reference: PROTEC 15676

To appear in: *Journal of Materials Processing Technology*

Received date: 17-11-2017
Revised date: 11-3-2018
Accepted date: 11-3-2018

Please cite this article as: Ma Z, Luo Y, Wang Y, Mao J, Geometric design of the rolling tool for gear roll-forming process with axial-infeed, *Journal of Materials Processing Technology* (2010), https://doi.org/10.1016/j.jmatprotec.2018.03.006

Geometric design of the rolling tool for gear roll-forming process with axial-infeed

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Abstract

Roll-forming process is an innovative manufacturing technology for the near-net-shape production of high-performance gears. Outstanding surface quality, high material utilization rate and short process chain are the essential merits of this process. The geometry of rolling tool has a significant impact on its lifetime and the quality of formed gears. In this paper, analytical models with consideration of geometric parameters of rolling tools (cone angle, tooth depth and addendum modification coefficients) were proposed to investigate the forming force, root stress of rolling tool, rabbit ear defect and scratches on tooth flank. Then, an example was studied by using the proposed models, Finite Element Method (FEM) simulation and experiments. The results show that the optimized geometric design of rolling tool will not only reduce the deflection and root stress of rolling tool's teeth, but also eliminates the scratches on tooth flank of the formed gear. Moreover, the positive addendum modification design of rolling tools also contributes to reduce the height of rabbit ear in the roll-forming process with axial-infeed.

Key words: Gear roll-forming process; Rolling tool; Forming force; Scratches; Rabbit ear