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Complete Machining of Gear Blank and Gear Teeth

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Complete Machining of Gear Blank and Gear Teeth

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[The statements and opinions contained herein are those of the author and should not be construed as an official action or opinion of the American Gear Manufacturers Association.]

Abstract

Demands for increased throughput, with smaller lot sizes at lower cost have led to the development of an innovative approach to machining both: the gear blank and gear teeth on a single machine.

This paper will concentrate on the potentials and risks of combined process machines what are capable of turning, hobbing, drilling, milling, chamfering and deburring of cylindrical gears. The same machine concept can be used for singular operations of each manufacturing technology on the same design concept. This leads to reduced amounts of different spare parts, increases achievable workpiece quality and harmonizes on a common user friendliness. In the end the economical potential of combined process technology and a vision for integrated heat treatment is shown.

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Introduction

Over the past years a large number of different machine tool builders have shown a tendency for combination of different processes into one machine [1]. The benefit and the limitations of such a concept including gearing processes is characterized by technical, commercial and local impacts. Increased flexibility and shortening down of lead times are the main driving factors of such developments.

Productivity in soft gearing processes

Due to increased flexibility requests on industrial serial production today batch sizes are decreasing [2]. In parallel the part complexity and the requested workpiece quality is increasing. For meeting

both requests the process chain has to be analyzed for shortening set up times (Figure 1).

In general the gear production of a forged or sawed blank part is characterized by subsequent manufacturing processes like turning, milling and/or drilling, hobbing and in most applications a rotary chamfering and deburring before heat treatment (Figure 2). Added by washing and marking operations as optional operations there are at least 5 different operations in the green stage for dry machining a geared workpiece [3,4]. Due to wet cutting, the demand on washing/cleaning and additional operations there are existing up to 12 different operations in gear manufacturing in today's green stage production. The focus of process optimization was in a first step the concentration on the 5 most important process technologies like turning, milling, drilling, hobbing and chamfering/deburring.

General market trends:

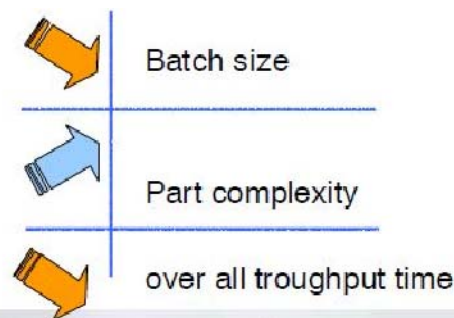


Figure 1. Why combination technology?