



American
Gear Manufacturers
Association

Technical Resources

12FTM11

AGMA Technical Paper

Contemporary Gear Pre-Machining Solutions

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Contemporary Gear Pre-Machining Solutions

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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

Depending on annual production volumes, batch sizes and workpiece geometry several gear manufacturing technologies are used for industrial gear production. Most applied is the hobbing process, followed by broaching, shaping, sintering and rolling processes. Upcoming gear manufacturing processes are power skiving, forging, precision blanking and cold forging. Due to improvements on the numerical control of direct drive technology the power skiving process has become a competitive gear manufacturing process in comparison to shaping, blanking and broaching. The potentials of the reinvented power skiving process will be explained by production volume analyses, achievable gear quality and gear geometry modifications. Also the economical and environmental friendly aspect of the power skiving process will be explained.

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1001 N. Fairfax Street, Suite 500
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October 2012

ISBN: 978-1-61481-042-1

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Introduction

Depending on annual production volumes, batch sizes, and workpiece geometry, several gear manufacturing technologies are used for industrial gear production. The one most applied is the hobbing process, followed by broaching, shaping, sintering and rolling processes. Up and coming gear manufacturing processes are power skiving, forging, precision blanking and cold forging [1]. Due to improvements in the numerical control of direct drive technology, the power skiving process has become a competitive gear manufacturing process in comparison to shaping, blanking and broaching. The potential of the reinvented power skiving process will be explained by production volume analyses, achievable gear quality and gear geometry modifications. The economic and environment friendly aspect of the power skiving process will be explained.

Productivity in soft gearing processes

Due to increased flexibility requests on industrial serial production today, batch sizes are decreasing [2], while 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 and reduced floor to floor times. One possibility in gear hobbing was the integration of chamfering and deburring work in the hobbing process. Such processes have been realized for horizontal and vertical workpiece orientations, as those shown in Figure 1 and Figure 2.

The benefits of the integration of chamfering processes into the hobbing process are given by reduced chamfer tool investments and higher accuracy of the hobbed lead. This is the basis for reduced stock removal rates on the hard finishing processes, such as honing or threaded wheel grinding.

A second possibility for universal gear manufacturing is the generation of internal or external gears by power skiving. In this manufacturing technology [3] [4], a tool is placed in a cross axis angle relative to the workpiece. Similar to the shaving process, chip building is initiated by the relative velocity between tool and workpiece (Figure 3).

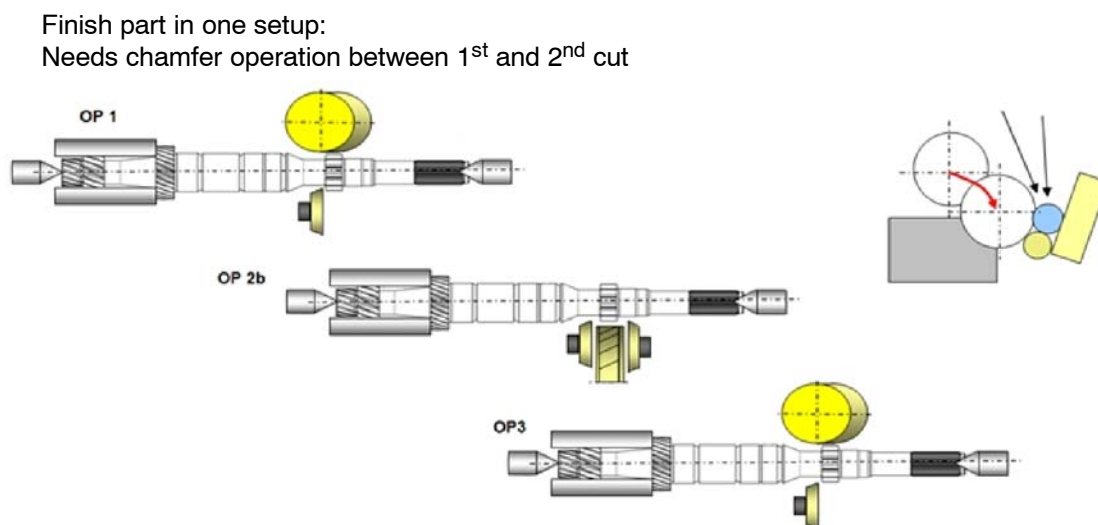


Figure 1. Integrated chamfering and deburring (horizontal workpiece orientation)