# Simulation support for the design of Precision Forging processes

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Abstract

FEA is widely used in forging design and tool optimization.

Precision forging modelling requires complex processes to be modelled with high precision. Special modelling features enabling complex tool designs, special material modelling techniques, extended friction description and others had to be developed and adopted.

The presentation will show examples of industrial precision forging processes that were developed using sophisticated FEA techniques.

Key words: FEA, precision forging, process design, tool design

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## Introduction

Precision forging is mainly defined as flash less forging with results close to net shape. Often this technology uses a combination of hot and cold forging processes as well. The aim is to produce high strength complex parts that have functional areas ready for assembly with close tolerances and excellent surface quality. If not possible then at least to reduce further machining to an absolute minimum.

Since years industry is more and more applying this method. FEA as the ideal tool to help to develop such processes was continuously further developed to match the requirements of the industry.

The presentation will show examples of successful developments in industry using FEA as development tool.

## Examples

### Production of a shock absorber

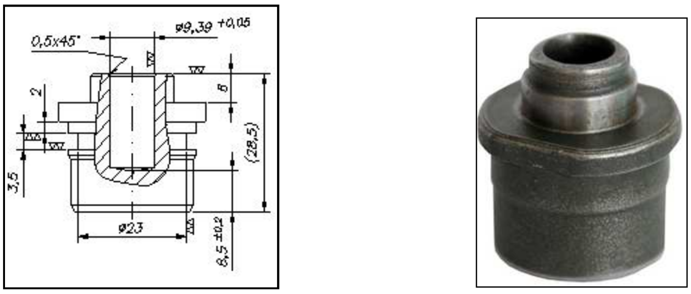


Fig. 1: Shock absorber

*The part may be produced in two different ways*

1. *Using multi-station machines*
2. *Using a single blow machine but more complex tooling*

The production on multi station machines is expensive and requires high volumes of production to be reasonable. Very often the hole cannot be forged and has to be machined.

This is why the second method may be the better choice.

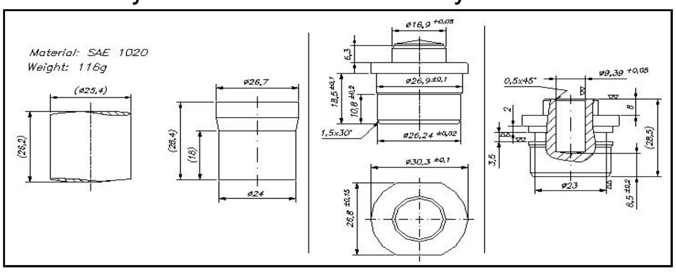


Fig 2: Traditional forging process

In this process may be intermediate heat treatment is needed.

## The alternative is to use a single stage process using hydraulic cushions

This process needs less material and the machining can be reduced.

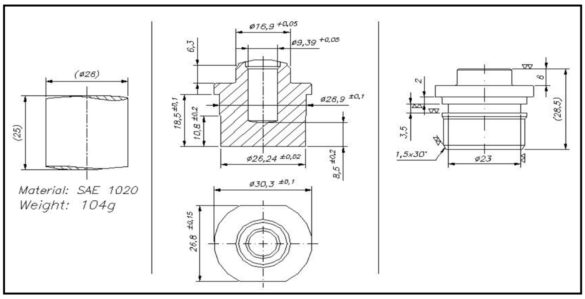


Fig. 3: Single stage process

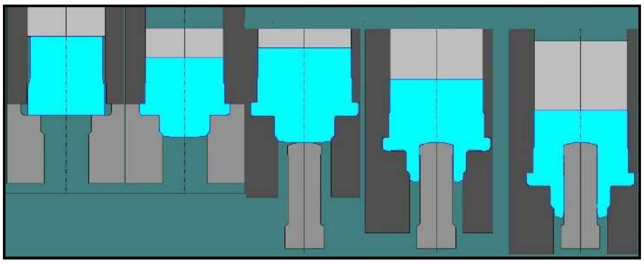

Fig. 4: The simulation shows the process [6]

With this approach hydraulic cushions enable the required tool movements. Using this technology, it is essential to study and check the process in FEA simulation before the expensive tools will be made.

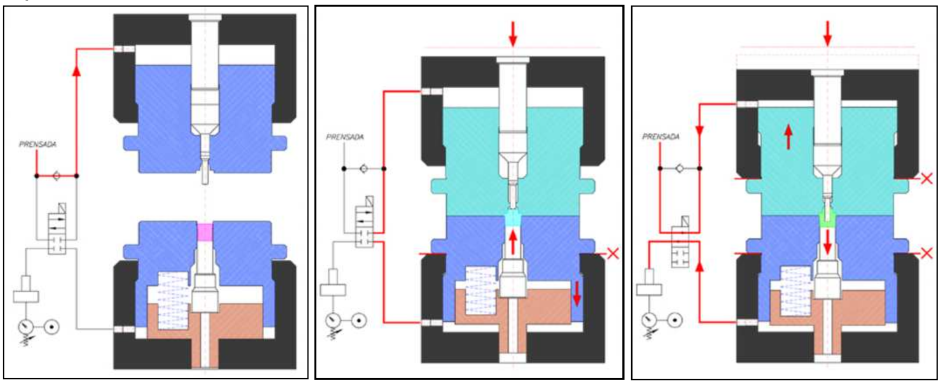


Fig. 5: The Principe how to use hydraulic cushions

More details will be given in the presentation.

## Brake piston – an example of using an innovative approach

Such a part is normally produced by backward extrusion. After upsetting a preform the piece may be heat treated before a standard backward extrusion is performed.

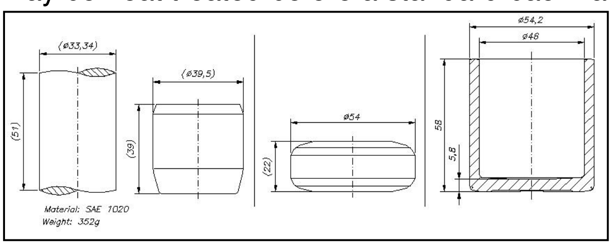


Fig. 6: Conventional method to produce a brake piston

The idea is to use the “Osen-Process” /5/ (Quer-Hohl-Vorwärts-Fließpressen) that is described in literature for aluminium parts.

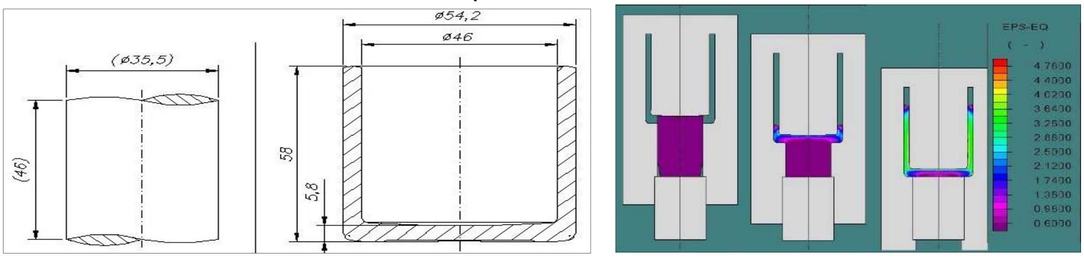


Fig. 7: “Osen-Prozeß”

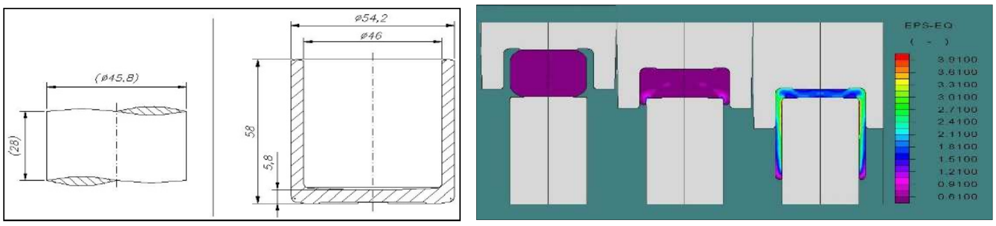


Fig. 8: Design using backward extrusion

Both process in general are needing about the same work to be done.

In the „Osen-Prozess“ the load applies on a smaller cross section. Less load is required and a smaller machine can do the job. The restriction is the stroke of the machine.

The work is about 65 kNm.
The „Osen-Prozess“ requires 180 to, while the conventional process requires 450 to.

Further examples will be shown in the presentation.

The following pictures show some of these applications.

Fig. 9: Claw pole

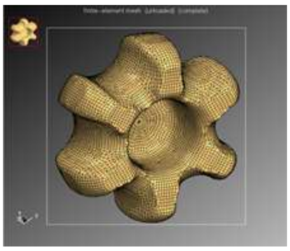

Fig. 10: Inner race

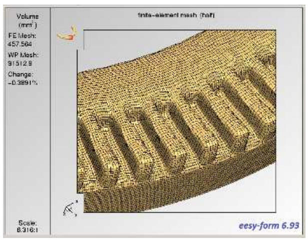


Fig. 10: Gear

Fig. 11: Tubular Connector

As they are examples of running production of actual parts no details can be given in the text.

## Closing remarks

The presentation shows examples how with good ideas and sound forging knowledge while using FEA as development tool excellent precision forging processes can by designed.

There is a high potential for future developments to meet the requirements of the market.

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