New concepts for conventional and 3D roll forming: control, forming processes, applications
Overview

- Introduction to 3D roll forming
- Industrial facility for truck long members
- Control concept for roll forming lines
- New process and machine concept for general 3D roll forming
- Concept for an industrial line for height-variable profiles
Introduction

Conventional roll forming

High potential for rollformed automotive parts

Increasing number of applications employing HSS and UHSS in the automotive sector

Source: welser.com

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Width– and height-variable 3D profiles

- Frame structures
- Side members
- Cross members
- Bumpers
- Body cross-members
- Front flap interior frameworks

- Roof members
- Door reinforcements
- Side impact carriers
- Window frameworks
- Window guidance
1. R&D machine (1999)

1999/2000:
data M develops the first control for 3D rollforming (COPRA® Adaptive Motion Control) for the research facility at PtU, Darmstadt
2007-2010: European R&D project PROFORM with 23 project partners (data M, Fiat, Daimler, Tier 1s and universities; budget: 5.5 mil. €)


data M:
- Definition/ simulation of forming steps
- Bipod forming stands
- Computer control
A new generation of machines for the automotive industry (2010)

POSCO RollForm research line developed and produced by data M (Source: POSCO)

2 mm DP 780
Industrial facility for truck long members (2015)

Flexible production equipment

More than 50 different long member geometries with a single setup!
Industrial facility for truck long members (2015)
High End control unit with „unlimited“ number of axes

In the truck long member facility the roll former alone contains more than 90 servo axes

→ Optimized operation concept using an appropriate HMI
→ Individual axis drives for forming rolls
Industry 4.0: data processing in production

**Encoder Wheel:** Position and velocity of the sheet for synchronization of the stands

**Measurement:** Current, Voltage, Power

**Hydraulic unit:** Pressure, Temperature, fluid level

**Pneumatics:** Pressure

**Pusher/Puller:** Position and velocity of the sheet for synchronization of the stands

**Drive of the rolls:** Velocity and torque for optimization of the forming

**Hydraulics:** Monitoring of the extreme positions

**Bipod/Monopod:** Position, Velocity, Torque for monitoring the axes

**Bipod/Monopod:** Additional monitoring of the position with a wire rope

**LP-Monopods:** Position -> Control of the pre-cut blank

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Industry 4.0 using OPC-UA: Controller to the Cloud

Synchronous monitoring and/or Asynchronous analysis

External Cloud

Database

Internal 'Cloud'

Database

Factory Floor

SCADA/HMI

MES

ERP

PLCs

Sercos the automation bus

ERP

SCADA/HMI

MES

PLCs

Factory Floor

Profibus DP • CAN • Ethernet/IP • Profinet

ERP

SCADA/HMI

MES

PLCs

Factory Floor

Profibus DP • CAN • Ethernet/IP • Profinet

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Human-Machine Interface (HMI)
Use your own device

- Application of modern mobile devices such as smartphones or tablets
- Direct access to the data of the OPC-UA-servers e.g. for diagnostics or maintenance

Source: OPC Foundation
Technology transfer to conventional roll forming lines

• Control technology
  – Individual or group drives with servor motors
  – Sensor technology
  – Optical inline measurements

• Improved simulation models using comparison with real data

• Monitoring methods for quality control or maintenance

• Enhancing energy efficiency and quality through self-optimization
New machine and roll forming concept for general 3D profiles
Objectives

- Development of a produccion process for complex (automotive) parts using roll forming
- Proof of concept
- Roll forming of high-strength steel
- Great flexibility combined with low tooling costs
- „Rapid Prototyping“
- Tool for research departments
Roll forming

• At first the pre-cut sheet is clamped between the upper and lower holding die of the core

• The roll forming tools follow 3D trajectories and the flanges are bent step by step around the upper die of the core until the final profile is achieved.
Implementation – The 3D Rollforming Center
Examples of height- and width-variable automotive parts produced with the 3D Rollforming Center
Control – COPRA® Adaptive Motion Control

Modular
Flexible
Easy to integrate
Network-ready
Extendable
Process-development for new, load-optimized profiles

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Development of a new measuring device – COPRA® ProfileScan 3D

Comparison with CAD model
Applications for the new machine concept

- Small series
- Materials research: new materials, UHS, hybrids,...
- Rapid Prototyping for OEMs / automotive suppliers: conventional and 3D geometries
- Process development and optimization
- Development and verification of concepts for industrial lines for mass production
- Roll forming research: „Big data“ for roll forming - industry 4.0,
- Further improvement of innovative measuring and sensor technology for roll forming
data M pioniers of 3D roll forming

Next step: Industrial line for height-variable profiles

Verification of the new line concept with the 3D Rollforming Center
Our offer:

• Roll forming of complex 3D automotive parts
• Control and sensor technology for conventional facilities
• New machine concept for research and development, and small series production
• Feasibility studies, prototypes
• Development of industrial production lines for 3D roll forming

It’s now up to you how you want to form the future.

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Many thanks for your attention!