3D Roll Forming Center for Automotive Application

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The COPRA® idea: an holistic approach to Roll Forming

COPRA® - Tool Design and Simulation Software
Process development, R&D Services

COPRA® Smart Stands

COPRA® Adaptive Motion Control

Material Testing: COPRA® FEA Bendtester for improved FEA Modeling

Quality Control: COPRA® RollScanner

Sensors: COPRA® ProfileScan

Industry 4.0 (IOT)
> 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
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
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 Mio. €)

Data M:
- Definition/simulation of forming steps
- Bipod forming stands
- Computer control
POSCO Steel RollForm research line developed and produced by data M (Source: POSCO)
Overview

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Industrial facility for truck long members (2015)

7 mm Domex 650

Flexible production equipment

More than 50 different long member geometries with a single setup!
Industrial facility for truck long members (2015)
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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
- **Hydraulics**: Monitoring of the extreme positions
- **Drive of the rolls**: Velocity and torque for optimization of the forming
- **Bipod/Monopods**: 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
Industry 4.0 using OPC-UA: Controller to the Cloud

Synchronous monitoring
and/or
Asynchronous analysis

External Cloud
Database
Internal 'Cloud'
Database

ERP
MES
SCADA/HMI
PLCs

Factory Floor
Profibus DP • CAN • Ethernet/IP • Profinet
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 servo 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
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New machine and roll forming concept for general 3D profiles
Objectives

• Development of a production 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
• Integration of new features into the roll forming process
3D 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
Development of a new measuring device – COPRA® ProfileScan 3D
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
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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.

Roll forming the Future® - data M
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