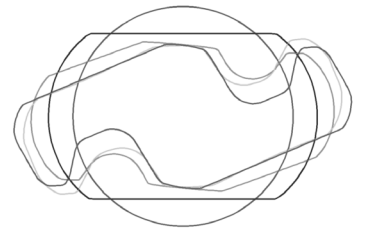
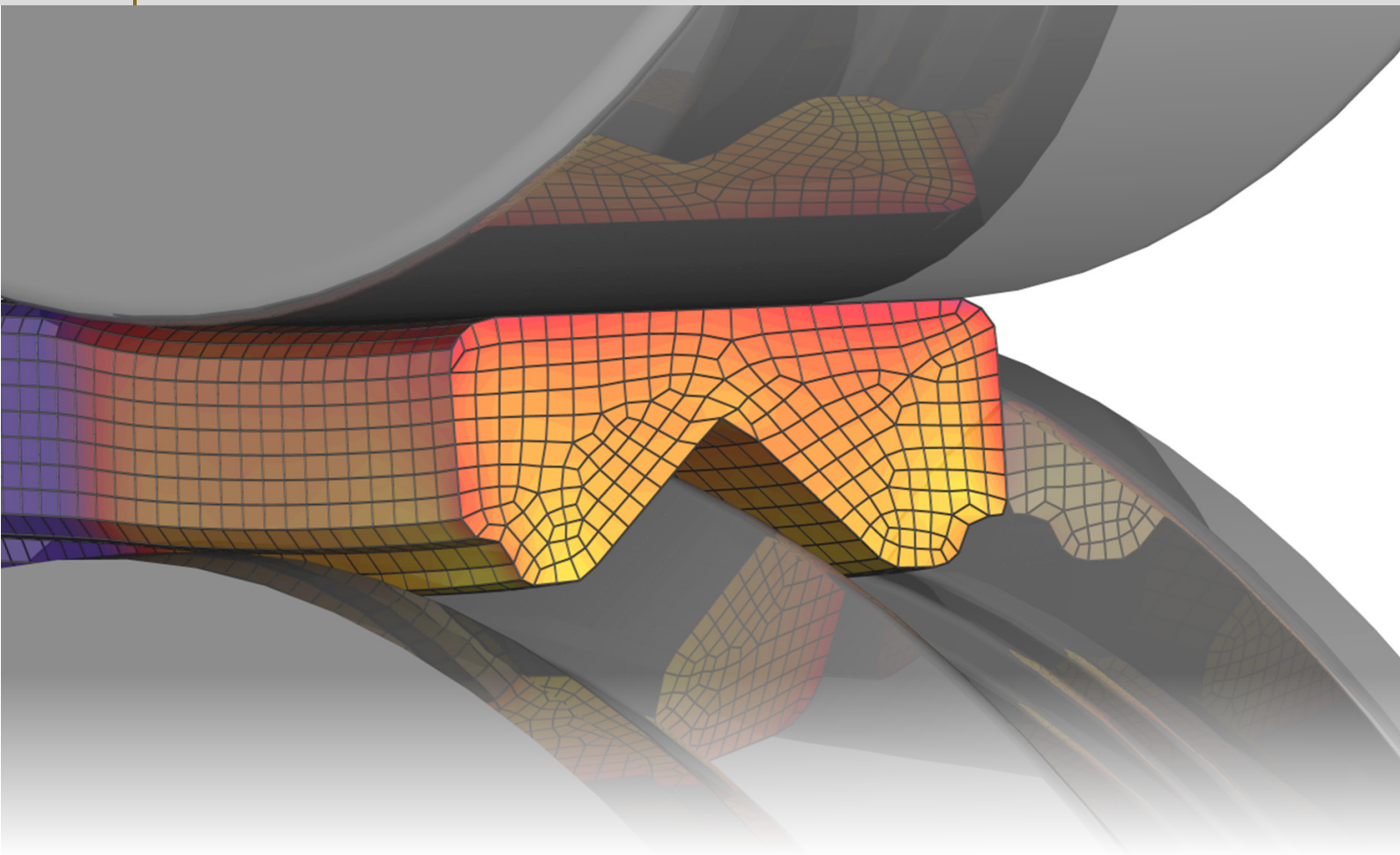


COPRA® WireRolling



Our integrated solution for the wire rolling of profiles includes both the design software COPRA® RF WireRolling as well as the simulation tool COPRA® FEA RF, for the analysis and verification of your wire projects. The advantages of an integrated solution, consisting of both design as well as simulation tools, particularly arise in the production of complex profile wires with ever smaller cross sections. It allows virtual optimization of the forming process and roll tooling during the design stage.



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High requirements for shaped wires

The production of complex profile wires with areas less than 100 mm² has increased significantly in recent years. These are often flat wires or special shapes for very different branches of industry. In order to produce profile wires, round or rectangular wires are formed by drawing dies or wire rollers. At the beginning of the procedure, only the initial and final shape of the wire is known. The material tends to shift in longitudinal direction while being reshaped and it can therefore be quite difficult to force it into the corners. This behavior also shows during simulation.

Calculations based on Finite Element Analysis are now applied in almost all industrial branches. They allow depiction and optimization of the production process as early as during the design process. The method can also be applied efficiently in production of wires, although there are still reservations among producers due to the complexity of the process. However due to ever enhancing technology, these reservations are now mostly unfounded.

Cut costs with our integrated software solution COPRA® WireRolling

A big part of expertise for implementation of such projects results from longstanding experience within the respective companies – just like in almost any other reshaping process. However, the more complex a product, the harder it is to evaluate the process beforehand. Without simulation technology, the making

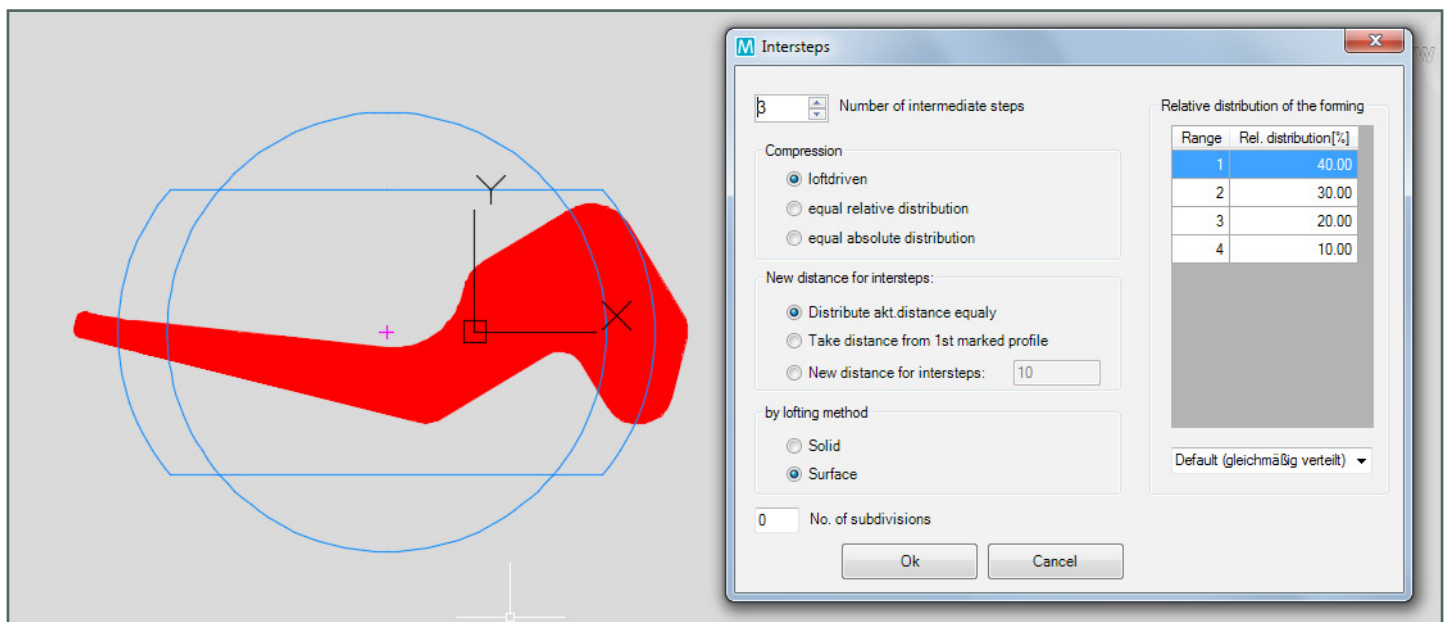
of new profiles mostly requires not only a high design effort, but also time consuming attempts regarding implementation of the rolling mill. The project can easily turn out to be a trial and error process, causing high cost due to machine down time. In a worst case scenario, a complete profile- and roll design needs to be made, roll tools as well as prototypes need to be produced – just to discover that the project cannot be realized.

To prevent problems of this sort, a software solution is needed that not only contains the design, but also the simulation process. Our COPRA® WireRolling solution provides an environment of this kind. The software covers the whole chain from the design of the respective forming stages to the simulation of the (virtual) finished tools as well as the depiction of the whole reshaping process. The particularly costly manufacturing of prototypes can thus be omitted.

COPRA® RF WireRolling

The focus of our design module COPRA® RF WireRolling is to optimize the respective shaping stations and to relieve the designers from many time consuming tasks. The designer can either draw the individual rolling stages and set the surface areas into the required percentile proportions, or COPRA® RF WireRolling automatically calculates the shape of the reshaping stations after definition of the initial and final cross sections.

The degree of reshaping as well as the prospective



Dialogue for calculating of shaping steps

reduction of the cross section can be defined by the user for the given situation. A manual modification is also possible at any time.

COPRA® FEA RF WireRolling

At last, the verification of the design can be conducted by our simulation tool COPRA® FEA RF WireRolling. Based on the roll contours as well as the starting cross sections, the software calculates the material behavior during the reshaping process. The expected shape and material alteration can be verified by reference to the respective station.

The knowledge about material alteration during the course of reshaping is commonly based on the experience of each designer. However, by means of Finite Element Analysis, a far more accurate verification of the reshaping process can be conducted, and thus a concrete prediction upon the wire being produced as desired, can be made. The method also allows determining how fast the rollers have to be driven so that the wire won't bulge.

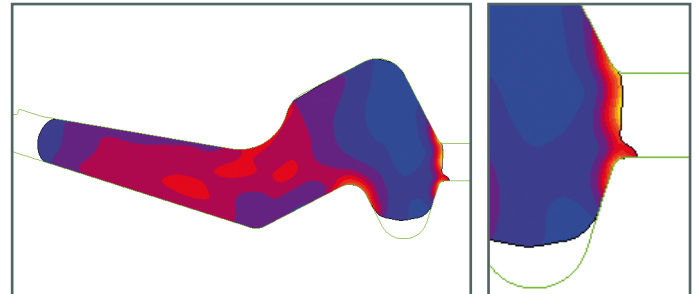
Furthermore, the appearing tensions and elongation is made visible. No dedicated FEA specialist is required for evaluation and the preparation of the model. The software automatically provides a model for simulation as well as specific tools for analysis of the simulation results.

Simulation of material behavior

The designer defines the material behavior by entering the mechanical material properties and COPRA® RF WireRolling calculates the required flow curve. The software also provides an analysis for the stress conditions within the material. It can thus be adequately evaluated if the wire becomes brittle and therefore is easily cracking. Additionally, it is visible if the wire arches or remains straight. The data provided during the analysis helps determining the total elongation of the shaped wire, the reduction in cross

section areas as well as the necessary forming forces to conduct the respective deformation.

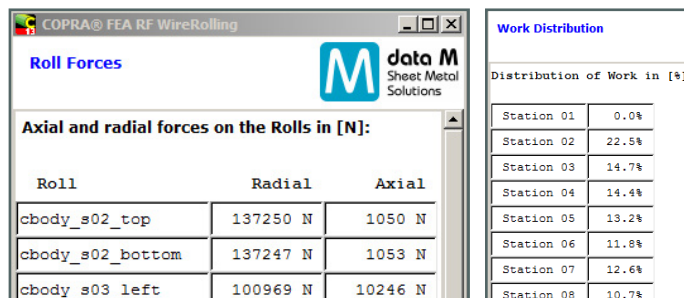
The roll tooling can thus be adjusted and improved on the basis of the simulation results. The effects of modifications regarding the initial cross section or the respective roll contours will also be available after a restart of the simulation procedure.



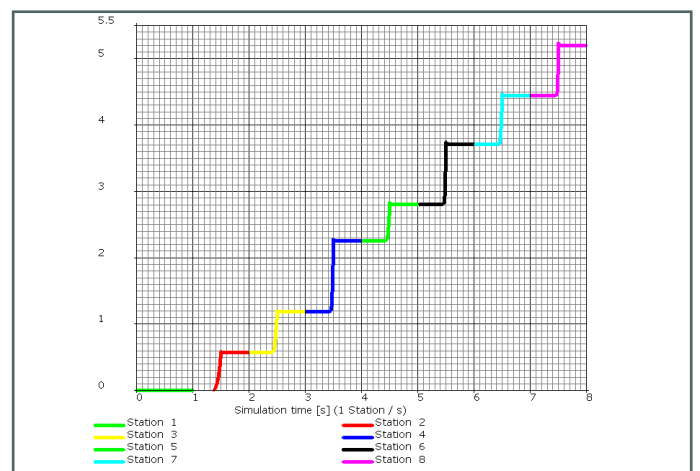
Burrs are showing up in this station

Stay competitive with the state-of-the-art CAD tools

The demand for ultra-precise, roll formed profile wires is very high. Nevertheless, there are risks to be considered. Particularly big projects can quickly cause exceptionally high cost. Our software solution COPRA® WireRolling enables manufacturers to optimize the reshaping process as early as during the design phase and thus adequately calculate the cost. Likewise, roll formers will increase customer satisfaction by supplying profile wires with the highest precision.



Calculation of shaping forces and distribution of deformation energy



Longitudinal elongations in the respective shaping stations

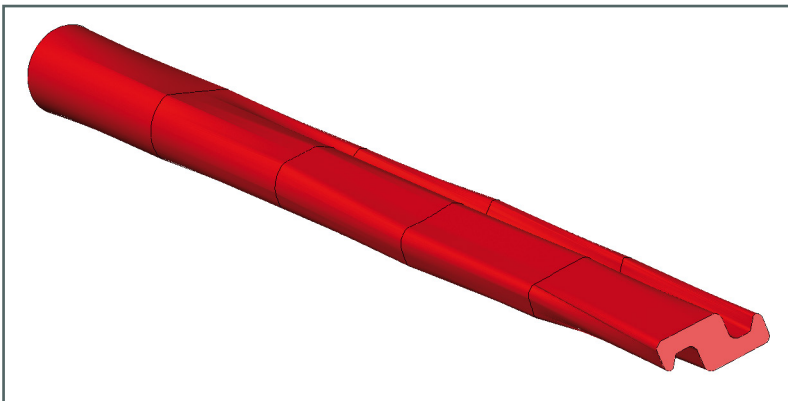
Features of COPRA® WireRolling

COPRA® RF WireRolling

- | Automatic definition of initial wire diameter
- | Interactive definition of rolling stages
- | Automatic calculation of shaping stations
- | Manual modification of calculated rolling stages
- | Effective design features for customised roll tool design
- | Automatic generation of material lists, NC- and DXF- contour data

COPRA® FEA RF WireRolling:

- | Automatic preparation of the FE model from existing COPRA® designs
- | Calculation of forming forces and distribution of shaping tasks among each station
- | Tools for analysis and interpretation of simulation results – no FEA expert needed
- | Dynamic animation of the reshaping process
- | Analysis of material flow occurring in transverse and longitudinal direction
- | Shows defects on the profile in case of a flawed design



Calculated shaping steps as a 3D model



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data M Sheet Metal Solutions GmbH
Am Marschallfeld 17 | D-83626 Valley
Tel.: +49 8024 640 0
datam@datam.de | www.datam.de

