Simulate IT BEFORE – trying it – because it saves effort and expense.

Albert Sedlmaier, Managing director of data M: »We work with scientific institutions in close conjunction.«

Stefan Freitag, Managing director of data M: »Today FEA simulation is the first step into practical implementation.«
One example is the manufacture of load-adapted profile shapes. As in the case of tailored blanks for instance, material and weight can be saved in the roll forming process. Naturally, the production processes called for here make special demands of the plant equipment and engineering. Fortunately such demands are easily overcome by the use of modern software technology.

Data M Sheet Metal Solutions GmbH is a provider of such technology, and their integrated COPRA® RF software program offers a process chain for the setup and validation of sets of rolls prior roll forming manufacture. The program comprises functionality for the development of open or closed profile cross-sections plus the appropriate roll tools, and includes simulation of the forming processes supported by the finite element method (FEM). The data M simulation solution is consequently a major production factor.

Reliable FEM simulation
Previously the only way to arrive at a correctly functioning set of rolls was by practical experimentation on the actual machine. Now there is an alternative to this time-consuming and costly verification of a new set of roll forming tools. It is faster, and there is virtually no need for rework of manufactured roll tools. What is meant by simulation of the forming process on a computer?

As soon as a set of rolls is constructed in COPRA® RF, the designed set of rolls is transferred into the FEM simulation program: COPRA® FEA RF (finite element analysis for roll forming), this is then used to simulate the roll forming operation by nonlinear elastoplastic calculation. The user does not even need to bother about issues such as the definition of the FE calculation model, discretization, selection of suitable element types or definition of boundary conditions, as these are automatically taken into account by the fully integrated software program in the COPRA® process chain.

A number of powerful analytical functions give the user dependable statements about the final profile quality to be expected or the properties of a product. That could be a precision pipe whose roundness is decisive for its use, or an automobile member where the end-user wishes to know how much energy it will be able to sustain. Both the finished profile and the individual stages of its forming are presented plastically in three-dimensional coloured images. The visualisation of any defects eradicates the need for empirical trials and adjustments on the roll forming line. Plus, the user starts to understand the roll forming process better, and is able to optimize the set of tools in the design phase already, saving time and money.

Getting to know roll forming
Not every business will need the full functionality of such a solution, so the complete software is modular in its makeup, being a scalable program, it is able to focus on and meet the requirements of the individual user.
An entire finite element calculation cannot run in a matter of minutes even on today’s fast computer systems. Instead a two-step solution has proven itself in practice: first optimisation by a fast analytical calculation approach COPRA® DTM (Deformation Technology Module) followed by validation of the complete set of tools by the FE method.

Of course the consequences for cold roll forming go far beyond reducing the time to validate a new set of tools and enhancing control of a process. The profile manufacturer now gets to know and experience the roll forming process in a whole new way, thus it is possible to eliminate in advance the kind of mistakes and problems that might occur with future new products.

R&D for living software

Because of their variety of application, roll formed parts have increasingly gained importance in recent years, and you find them today in new sectors like the automobile industry. That means a very much larger selection of cold roll formed profiles plus the use of new materials exhibiting higher breaking strength – although poorer roll forming properties. For data M Sheet Metal Solutions it creates a continuing demand for further development of its COPRA® RF software program. Here the company is supported by the research results from various roll forming projects.

The history of data M Sheet Metal Solutions GmbH goes back to before the actual establishment of the company. Founder Albert Sedlmaier, Dipl.-Ing., was engaged as a scientific assistant in the department of mechanical engineering and design of Munich Technical University from 1982 through to 1987, as part of a project of what was then a research association for steel applications, now the FOSTA group in Düsseldorf. Sedlmaier conducted research on the subject “Knowledge-driven design of roll forming tools – CAD/CAM applications”.

The work and developments from this period of research inspired the young engineer together with Stefan Freitag, another engineering graduate, to found data M Software GmbH in June of 1987. The company’s activities were originally aimed purely at software development. Gradually this also turned into process simulation.

Today, 23 years later, data M is again engaged in a FOSTA project. Basically this is focused on mapping simulated bending tests and simple roll forming tests, and verifying the simulation by the experiments that are conducted. One of the aims is to determine which material models and element descriptions optimally map the measured reality.

Development of flexible roll forming

About ten years ago we saw the development of what is called “flexible roll forming”, by which a new kind of adjustable roll stand also makes it possible to produce cross-sections that are discontinuous on the longitudinal axis. The first generation of this kind of equipment was born of
The possibility of bending a strip of sheet metal free of moment in the test rig produces a more precise description of material behaviour than previously. For example, the test allows marked differentiation of the bending response of metal strip in and opposed to the direction of the coil. This difference in material behaviour is also clearly evident on the rolled parts.

As part of a project with Deakin University, it is now intended to implement the improved description of material behaviour in data M’s COPRA® FEA RF software, where it will produce more precise description of material behaviour than previously. For example, the test allows marked differentiation of the bending response of metal strip in and opposed to the direction of the coil. This difference in material behaviour is also clearly evident on the rolled parts.

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A further research project, with data M as the coordinator, is RFexpert. Here the aim, among other things, is to investigate the effects of different
parameters such as friction and work hardening on the quality of cold rolled cross-sections, thus ensuring constant quality of the profiles to be manufactured, by suitable methods of measurement and the use of an expert system. It is expected that the finite element model used to simulate the roll forming process will be very much improved in its performance by this project.

The data M service centre
For a number of years now data M Sheet Metal Solutions has been thinking about expanding its selection of services so that it can better communicate the expertise constantly being developed to its customers all over the world. For this purpose the company has already established offices in the USA, India, Brazil, Poland, Sweden and Britain. In this way data M engineers are always receptive to the needs of customers, to what is happening on the market. This facet of data M service will continue to grow.

A further, major aspect is that here, in Valley, Germany where the company is based, data M intends to set up a service centre in the course of the next few years. An industry-compatible prototype plant will be developed and built for flexible roll forming of sheet metal profiles with discontinuous cross-sections on the longitudinal axis. Entirely new in this project is that for the first time industrial standards in the automobile industry for 3D profiles are to be achieved. Intelligent control, reliable simulation and patented process engineering are essential for controlled roll forming operations of sheet metal strip.

Modern engineering
Both suppliers and machine manufacturers to the automobile industry still lack expertise and experience in this specific technology, which is why investment by industry has been hesitant for a few years now, although the advantages of the new technology are fairly obvious:

- More flexibility than press moulded parts (each needing an extra tool) and greater variety of form (e.g. closed profile forms).
- Cost benefits through continuous production.
- Fabrication of complete part families on a single installation.
- Better formability of high-strength and ultra-high-strength steel as well as aluminium, etc.

A test laboratory will also be set up – specialized in roll forming – and its services made available to industry. Through the planned project data M Sheet Metal Solutions intends to offer its customers efficient and competent services for implementing the entire process chain of roll forming flexible cross-sections from their calculation and design through to the creation of a complete industrial plant.

The future services will comprise the following:

- Generation of a feasibility study.
- Devising of a (partly) new machine and roll forming concept.
- Production of any lacking components for the prototype plant.
- Manufacture of 10-20 parts with the required profiles.
- Planning of the industrial plant and either delivery of the complete industrial plant to the end-user as a general contractor, or consulting of individually selected machine manufacturers to produce the plant(s) for selected end-users.

Load-optimized profiles
To convince the automobile industry, among others, of the advantages of 3D roll forming, this prototype industrial plant will later produce prototypes of the parts desired by the potential user - irregular and of course conventional profile cross-sections too - as evidence of their feasibility.

The new process also makes it possible to fabricate so called load-optimised profiles, i.e. with profile cross-sections optimally matched to their particular load. On the structural parts of automobiles and trucks, such as cross and main members, that can mean a weight saving of more than 20 percent, which other technologies can often only achieve through much more effort and expense.

The economical and ecological effects are also very respectable. Assuming a vehicle drives 100,000 km, the total saving is 4 litres of fuel per kg saved*. That is not only economically but environmentally sound.

Especially worth mentioning about this new process is that it is very cost effective and economical in terms of tangible benefits produced by money spent, giving vast savings in the long run. Given the high flexibility of the process combined with the effectiveness of roll forming, whole assemblies and similar part families can be produced on a single roll forming line.

(*Based on: saving of 0.4 liters / 100 km per saved 100 kg)

Albert Sedlmaier
www.datam.de
Customer proximity is exceptionally important – data M expands its business all over the world

R&D work is daily routine for the data M team. That is what established the reputation of the company as being a problem solver or, as Albert Sedlmaier comments with a smile, as a troubleshooter. Companies from all over the world called for the Upper Bavarians and asked for assistance. Very soon Sedlmaier realised the high potential that derives from the internationalisation of his firm and its services. Consequently he and his co-founder began to look for distribution and engineering partners in Europe and overseas with whom they can market not only their software products but also their services. This local presence helps data M to improve its customer proximity and its practical relevance, which is most important for its work. Goal of this expansion policy is to establish many of the so called “data M competence centres”, in which the parent company holds the majority. By establishing these branch offices the roll forming experts can any time keep an eye on the market developments and are able to react fast and flexibly to the wishes of their customers all over the world.

data M Sheet Metal Solutions – a highly technical service centre

So far data M delivered the feasibility studies and the tooling as well as the roll forming concept to its customers. These services will in future be added by a machine, which can produce prototypes of rolled sections. Not only on the basis of “flexible roll forming”, on which data M has been working for many years, the company in future will be in a position to offer its customers a complete concept consisting of theory and practical experience – from feasibility studies and the tooling concept as well as the roll forming concept to the prototype of the section. Once a client has accepted the overall result data M will as a consultant assist the roll former in realising the concept.

Visit us at our booth:
October 26-30

hall 27
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