

RESEARCH NEWS

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MS Wissenschaft exhibition in 2018: efficient cutting plans with „AutoBarSizer“ Math puzzle for better material utilization

Companies that process steel usually require customized cutting of steel bars for their products. As a result, steel traders are faced with the challenge of meeting customer-specific requirements while producing as little scrap as possible. That means they have to divide the inventory as efficiently as possible in terms of material. Researchers from the Fraunhofer Institute for Algorithms and Scientific Computing SCAI have developed software that addresses this problem and minimizes the amount of generated scrap, therefore optimizing material utilization.

Steel is a most versatile material and is used to make countless products – from kitchen knives and reinforced concrete to aircraft turbines and ocean liners. Year after year, well over a billion tons of the metallic material are produced and processed. From production to finished product, however, it is a long journey that produces several hundred million tons of scrap per year. For example, steel traders cut their standardized steel bars to exactly the lengths required by the customer – a process that results in a lot of scrap. The challenge is therefore to make the cuts so that as many usable rods as possible can be cut from the stock. Earlier solutions to this challenge have often been unsatisfactory. However, experts from the Fraunhofer SCAI in Sankt Augustin, Germany have come up with self-developed software, the "AutoBarSizer", which significantly reduces the amount of scrap produced and provides very good material utilization, thereby significantly reducing the costs for steel traders.

Notable increase in efficiency

"Our software calculates cutting plans that are based on the bars in the dealer's warehouse and include both new standard-length bars as well as remainders of different lengths," explains Thomas Weyd of the Fraunhofer SCAI. "In a pilot project, we were able to increase material utilization by seven percentage points and reduce the remaining stock by 25 percent." For the large volumes of steel that are processed, this increase in efficiency pays off quickly. With a steel price of 500 euro per ton and a processing volume of 50 tons a day, for example, an improvement of just one percentage point can save the steel trader as much as 5,000 euro a month.

The software can be adapted precisely to the respective circumstances. The settings include not only parameters such as machine properties, but also the point at which remainders from cutting should be reused or scrapped. In addition, in calculating the

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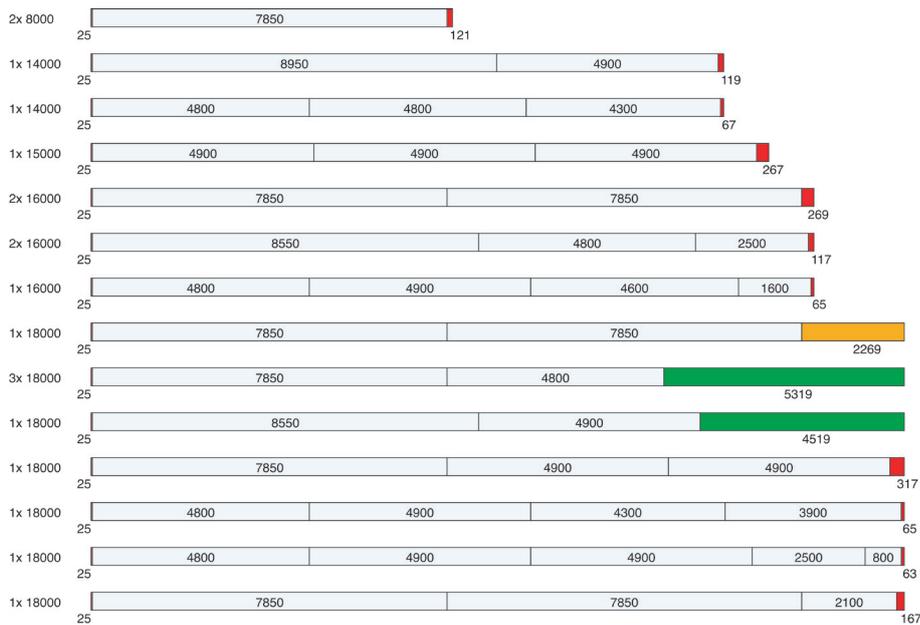
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optimal cutting plan, the "AutoBarSizer" also has access to the inventory and remaining stock data. Based on these factors, the responsible person can use the program to create different cutting plans with different emphases. For example, a cutting plan that results in as little scrap as possible and one in which as many remnants as possible are used up. The dealer can therefore either save on materials, optimize the remaining stock or choose a combination of the different variants.

Algorithmically optimized cutting plan

Based on the material inventory, the algorithm of the Fraunhofer SCAI calculates results which are very good and often verifiably optimal. "The basic mathematical problem has already been well researched," says Weyd of the Fraunhofer SCAI. "The challenge we have solved with the "AutoBarSizer" has to do with the everyday constraints. Miter cuts are particularly a real challenge: with a straight cut, the whole thing is primarily a matter of arrangement. For miter cuts, some additional parameters have to be taken into account." For example, distances of incompatible miter angles have to be considered. In addition, there is the possibility of rotating the bar or changing or mirroring the angles. The software of the Fraunhofer SCAI not only mathematically depicts these factors but also suggests efficient solutions that save material, costs and time.

With the "AutoBarSizer", the experts at the Fraunhofer SCAI have solved various issues that arise during planning for rolling mills and steel traders, in the woodworking industry as well as for manufacturers and processors of all types of bars.



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AutoBarSizer calculated cutting plan with leftovers. Green: reusable remainder (type 2), yellow: reusable remainder (type 1), red: scrap. © Fraunhofer SCAI