Laser cutting breaks new ground

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For a while, there have been two possibilities for creating a laser cutting plan. Conventional cutting plan programming is the first option. However, with this method, users waste time and raw materials. So AL-Cut AG (Inwil, Switzerland; info@al-cut.ch) chose the second option: the ByOptimizer from Bystronic.

Toni Räber’s phone rings. The customer at the other end of the line needs metal struts for staircases: 800 parts, complex geometry, made of 10mm steel. “Can you manage that by tomorrow? I will send you the details by e-mail.” An urgent job, but Räber remains relaxed: “We will prepare an offer.”

Räber is one of AL-Cut AG’s two managing directors (FIGURE 1). As a service provider in the field of metalworking, the company supplies customers throughout Switzerland. Recently, the nine-man company took up quarters in a new production hall near the Swiss city of Lucerne. “We produce small series, also prototypes. Until now, jobs exceeding 500 parts tended to be the exception,” Räber says. For large series, it is difficult to prevail in the face of the hard price competition.

However, times are changing because for several months, AL-Cut has been using the ByOptimizer—an online service from Bystronic that optimizes laser cutting by breaking new ground in the process of generating cutting plans. The service is based on a newly developed cluster technology, which aligns the parts that are to be cut so closely on the metal sheet that the gaps (i.e., raw material offcuts) are reduced as far as possible.

Placing the parts so closely together shortens the laser’s cutting paths. In addition to saving raw material, this also enables reduced cutting times. As Räber explains, that is precisely what is important: materials and cutting time.

Reducing costs by mouse click

Räber says that the lower a job’s consumption of materials and the shorter the cutting time, the better the price. And these are the key elements of making the customer a good offer. Usually, customers obtain quotes from several suppliers, which is why the price is the decisive factor in the end. “Simply using a fast laser is only half the battle,” he says. Although it enables fast cutting speeds, the preceding process step is decisive: optimal grouping of the parts on the metal sheet.

Just a few minutes after the call, the e-mail with the customer’s order data arrives at AL-Cut. Now it’s up to Thomas Seeholzer, AL-Cut’s laser cutting expert. He enters the data from the e-mail attachment into the laser system’s BySoft 7 software (FIGURE 2). The screen displays an elongated part that looks rather like a coat hanger. “I am curious to see how the
ByOptimizer will place that on the sheet metal,” Seeholzer says.

The challenge is to group 800 of these polygonal parts on several metal sheets so that as little residual material as possible is wasted (FIGURE 3). Seeholzer performs another check of the part’s CAD drawing and then sends the file to the ByOptimizer for the next processing step. The online service is integrated directly into BySoft 7—this simplifies data processing because the user remains within the BySoft 7 software interface during all the process steps.

Seeholzer clicks on the “upload” button and everything runs automatically. The ByOptimizer sends the job data to the server center, where an algorithm is applied to the data—generating a cutting plan with the software that includes a database incorporating more than 300 parameters to provide comprehensive information about ideal cutting processes and the varying behavior of the material to be cut. Based on all this information, the ByOptimizer creates the ideal cutting process for the 800 parts of AL-Cut’s customer enquiry.

It’s as though 300 experts were simultaneously working to create the best possible cutting plan for AL-Cut. All the relevant aspects are taken into account: Are the parts that are to be cut placed ideally on the metal sheet? Are the laser’s cutting paths and feed rates programmed in a manner that prevents risks? Can the undesired heat, which the laser produces within the cutting material, be reduced? How many piercings are necessary per contour? Must micro joints be included in the cutting plan to be able to attach the cut parts to the residual sheet?

After just 50 minutes, Seeholzer receives the finished cutting plan. He looks at the grouping of the parts on the screen and is astonished: “There really is hardly any waste material left on the residual sheet,” he says. On the virtual cutting plan, the parts are placed so closely together that many common cutting edges are created with only a few gaps remaining. This type of grouping has two benefits: It saves space on the metal sheet and reduces the cutting time. With common contours, one cut is sufficient where two would otherwise be necessary.

The ByOptimizer offers a major advantage when preparing the offer for the customer, Seeholzer explains. With the aid of the online service, one can calculate using very precise data and, thus, prepare a precise offer in a relatively short period of time. The ByOptimizer’s virtual cutting plan provides him with all the important information in advance: the amount of material required, the cutting lengths, and the processing time. AL-Cut only makes a booking for the cutting plan once the customer confirms the order.

**By hand? Impossible**

What would it take to manually create a cutting plan that is comparable to one generated by the ByOptimizer? Seeholzer laughs: “A great deal of know-how and patience.” As the programmer, one has to know the precise behavior of the sheet metal when the laser cuts it. The material behavior changes depending on the cutting speed and the power of the laser, and the heat that the laser beam generates within sheet metal causes stresses in the material. This in turn can cause problems, particularly when cutting closely grouped parts.

The ByOptimizer takes account of all these details, which even experienced users cannot keep in mind all the
time—particularly when things are hectic. “Like today,” Seeholzer says. “The enquiry for a job comes in and in order to save time, I do not want to spend a lot of time creating the cutting plan.” The services algorithm is more precise than a human, particularly in the stressful, day-to-day business environment of a job shop.

AL-Cut receives the order, the customer confirms the offer, and the delivery period is 24 hours. Now, Seeholzer books the cutting plan in the ByOptimizer and sends it directly to their 6kW Bystar cutting system. One can tell that the machine is put to hard use here—the company logo on the upper edge of the safety door is worn away, but this does not affect the system’s ability to handle high workloads. Seeholzer and Räber perform a final check of the cutting processes on the laser cutting system’s screen, and then the machine starts to work: 800 parts on 11 metal sheets and a total cutting time of less than four hours.

After the laser’s initial cuts, Seeholzer checks the cut parts. He stops the laser, opens the safety door, and removes two cut parts from the cutting grate. “Clean cutting edges. A good result,” he judges. In terms of quality, the use of the ByOptimizer at AL-Cut must achieve the same level as conventional cutting plan programming. The raw material savings and shorter cutting times, which are made possible by the online service, only provide a competitive advantage for AL-Cut if the final results are first-class (FIGURE 4).

“Naturally, at first we had some concerns. We were skeptical,” Räber explains. In contrast to cutting plans that are created using the conventional procedure, using the ByOptimizer means relying on a completely new technology. But it soon became clear that the online service provides good results. And it is stimulating business even more, such as for large-series orders. With these, the service speeds up the entire workflow, from the offer to the optimal grouping of the parts to be cut on the metal sheet, and to the error-free cutting on the laser cutting system.

After approximately four hours, all of the 800 parts are cut. Seeholzer has already neatly stacked the metal struts on pallets. Behind the laser cutter, there are now 11 delicate residual sheets. He lifts up the one lying on top: “There is not much left here to go to scrap.” (FIGURE 5) AL-Cut was able to save approximately 30 percent of the material on this job. Without the ByOptimizer, there would be at least four additional residual sheets with a great deal more material left on them.

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