Different angles on bending automation

Adding a robot to a press brake is nothing new. But technology on both sides has moved on. Andy Sandford looks at recent developments

Safan built what it believes was Europe's first robotic press brake system as long ago as 1988, yet in the UK, automated bending cells are still relatively uncommon – especially compared to the number of automated punching and laser systems installed.

The main barriers to wider use have been inflexibility and the complexity of programming the robot and press brake to act as a single unit – compounded by the time-consuming teach-in programming methods.

If these limitations can be overcome, the benefits of automation are clear. Labour costs are reduced, skilled staff are not tied up operating the machine, there are no operator errors and the system will carry on working unmanned 24 hours a day.

Where the cells have been successful, they are often operating on relatively high volume components or families of similar components – particularly in OEMs – where lengthy set-up times are less important than consistent unmanned production. Elsewhere they are used for large or unwieldy components in medium to high volumes that would otherwise require two or more operators to produce.

Cells tend to be designed around the axis movements of the robot – in a lot of robot cells the machine is mounted on a plinth so that the robot has more freedom of movement to present parts to the press brake tools. An alternative is to mount the robot on a gantry attached to the press brake. In either case the result is that it becomes almost impossible to operate the press brake manually, which means that another machine is required if there is also a requirement for small batch or prototyping work.

ROBOT IN DISGUISE

In designing its BendMaster press brake automation system, Trumpf decided against the inclusion of a proprietary industrial robot in favour of a dedicated 4-axis manipulator arm that runs on a Z-axis track parallel to the press brake. The primary objective was to avoid the integration of two operating systems. Although the manipulator looks like a robot, it is essentially an extension of the press brake system and is programmed offline using the same Trumpf TruTops Bend software.

This configuration and working

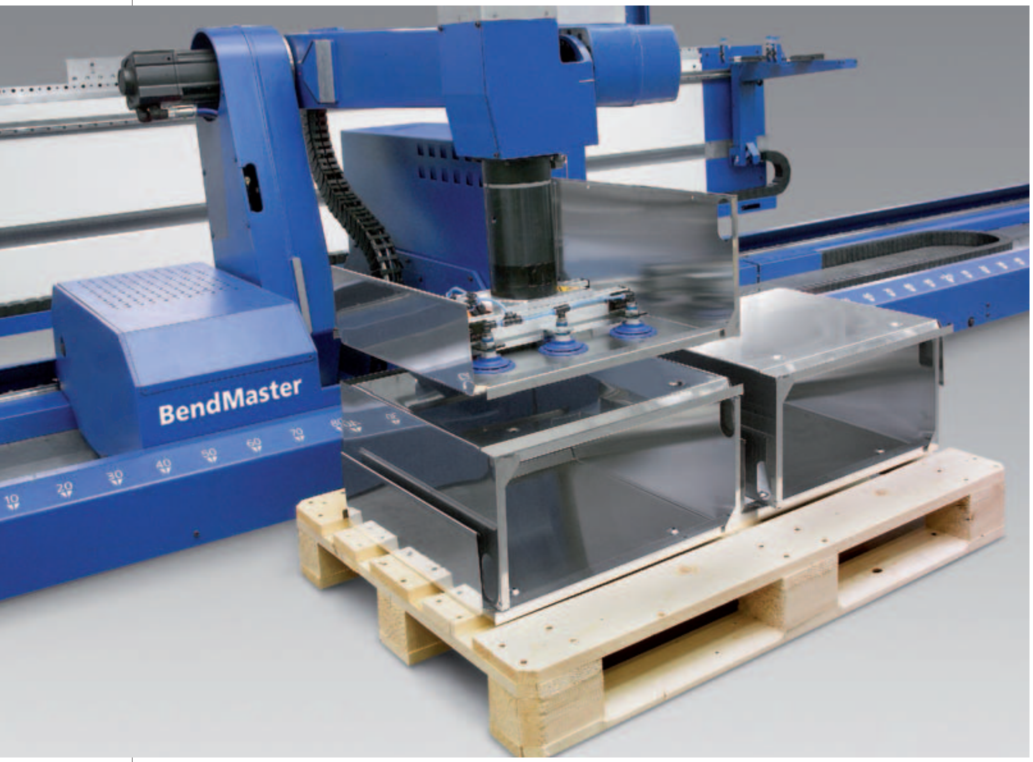
envelope mean that the press brake can be mounted at the normal height. So, by parking the manipulator arm out of the way, an operator can have easy access to operate the press brake manually.

Programming and control are completely integrated. The press brake and manipulator can both be operated from the BendMaster control and programming is carried out using the standard TruTops Bend software. The first three programming steps are the same whether you are writing a program for manual bending or automated operation. This avoids unnecessary duplication and enhances productivity.

For a manual press brake you start with the blank, add a bending sequence, define the tooling and simulate the bend sequence to check that it works. The software then simply generates the NC code to control the machine. On an automated system you then have to define the approximate positions for loading and unloading, which doesn't have to be precise as the manipulator head incorporates a vision system. This locates the stack, then defines the key points that the manipulator needs to achieve during the manufacturing cycle. The software then plots all the paths and shows a 3D simulation. The press brake program automatically tells the manipulator what it needs to do.

"This is standard offline programming software, not something you have to add as an extra," says Nick Damjanovic, general sales manager of Trumpf, Luton. "On a typical part with maybe nine bends it takes around 30 minutes to program: 15 minutes to create the basic bending program and another 15 minutes to add the automated cycle, so there is no real time barrier to programming small batches.

"Trumpf decided not to automate with a standard industrial robot because it was easier from the programming point of view to develop a manipulator that was linked to the press brake. You can write the software to produce the component and the manipulator is programmed automatically to follow the bend cycle," he says.



Trumpf's approach sees it's own design of manipulator used rather than a standard robot

A number of features ensure that the system is optimised for automated operation. The vision system on the manipulator head, for example, carries out a number of functions that reduce the need for manual input. As mentioned above, there is no need to accurately place the load and unload pallets. They can simply be dropped in by a forklift and the vision system will find them.

The blanks don't need to be accurately aligned either, as the vision system detects the alignment of the stack, measures its height and recognises specified features so that the grippers can pick it up in the correct orientation. This saves time by removing the need for the blank to be placed in a separate alignment station and re-gripped. As the manipulator picks up the blank it also weighs it to make sure it has only picked up one sheet.

GRIPPING SOLUTIONS

A range of different gripper types can be used – standard vacuum cups, suction pads for components with cut outs or perforations and mechanical grippers for smaller components. These are attached to the manipulator arm using a common fitting and can be changed automatically if required. A programmable re-gripping station on the front of the press brake allows the manipulator to reposition itself with respect to the part.

Once the part has been formed, the way it is unloaded and stacked is freely programmable, giving a high degree of flexibility. Parts can be stacked on a pallet, placed in stillages, interleaved with cardboard or stacking pieces, arranged in different orientations or placed on a conveyor belt. The use of conveyors means there is no need to stop production to replenish stocks of material or remove formed components.

"You can only justify an automated

Robocell is mid-level technology offering a good trade-off between automation and cost, says LVD

robotic or manipulator system for medium to high volumes. Writing the program isn't an issue, but physically changing the tools and putting the stack in the right places is going to take maybe 15 minutes. If you are only going to run for 15 minutes then it isn't really worth automating," Mr Damjanovic explains.

HIGH VOLUMES OVERNIGHT

"If you are doing low volumes you would never dream of putting them onto a robotic system, you would use an operator. What people tend to do is to run small batch and intricate work manually during the day and run medium to high volumes on the same machine overnight," he adds.

The BendMaster can be used with any of the Trumpf TruBend 5000 series press brakes on sheet up to 2,000 by 1,000 mm and weighing up to 40 kg. The standard length of the Z-axis track is 4,000 mm with a maximum travel of 2,550 mm and this can be extended in 2 m sections up to 14 m for larger press brakes to incorporate more load/unload positions or create twin machine cells.

LVD's approach to automation is rather different to Trumpf's and is focused on using proven technology, such as industrial robots, to create affordable systems that use an appropriate level of automation for the job.

As Matt Fowles, LVD's group marketing manager, explains: "Our aim is to offer intelligent solutions to our customers. So for each of the technologies we offer – punching, laser cutting and bending – we have entry-level, mid-range and high-end products so that we can offer the ideal solution at a level that matches their needs."

He says that around 65 per cent of LVD's customers are sub-contractors, and they want automation that is affordable and gives them a quick return on their investment. For this reason LVD has focused on mid-level automation where there is a good trade-off between automation and cost.

"That is where our customers are and that is where we see the demand. You won't see us making big automated production lines," says Mr Fowles.

A good example of LVD's approach of integrating standard robots with its machines is the Robocell. This is a flexible and compact automated bending cell for small and medium-sized components that combines an LVD PPEB press brake with a Kuka handling robot. As with the Trumpf system, a fundamental aspect of its design is that it can be operated as a stand-alone press brake as well as an automated cell.

The press brake is mounted at a normal operating height, not on a plinth, and the robot is placed 2 m away from the bend line to allow unhindered access for a manual operator. The cell can be configured to suit the available space and would normally include two input stations, a centring table, a re-gripping station to allow the part to be repositioned and turned over, and two output stations. Maximum component weight is 15 kg and the largest press brake it can incorporate is a 110 tonne, 3 m bed machine.

Mr Fowles adds: "We saw that there was a significant gap in the market, between stand-alone machines and the Roboformer system we developed with Salvagnini for larger components. The Robocell is designed for smaller components and medium-sized components and it is pitched at an affordable level. Customers, and particularly sub-contractors, need to look at how they can reduce their cost per part and press braking is quite a manually intensive process, so they are looking at ways of optimising that manual content. By being able to combine manual and automated operation on the same machine they will be able to maximise their return on investment and better use their assets."□

Robots for punch presses, too

LVD has also used robots to automate loading and unloading of punch presses. At EuroBLECH it will be showing its Pick-Sort system, which uses a Kuka robot to turn a Strippit V-series machine into an automated punching system. The robot is simple to program and uses preset trajectories to transfer sheet to the press and punched parts on to an output stack.

"Although we have a strong focus on automation we don't want to over-automate. We are aiming for the sweet spot where we balance the labour cost against the investment cost to get the optimal overall cost per part. Also, we don't want over-complex systems. When you start moving to higher levels of automation, systems not only get more expensive, they also get more complex and hence more unreliable. Robots use proven technology. They are standard products that are affordable, flexible and reliable," Mr Fowles underlines.