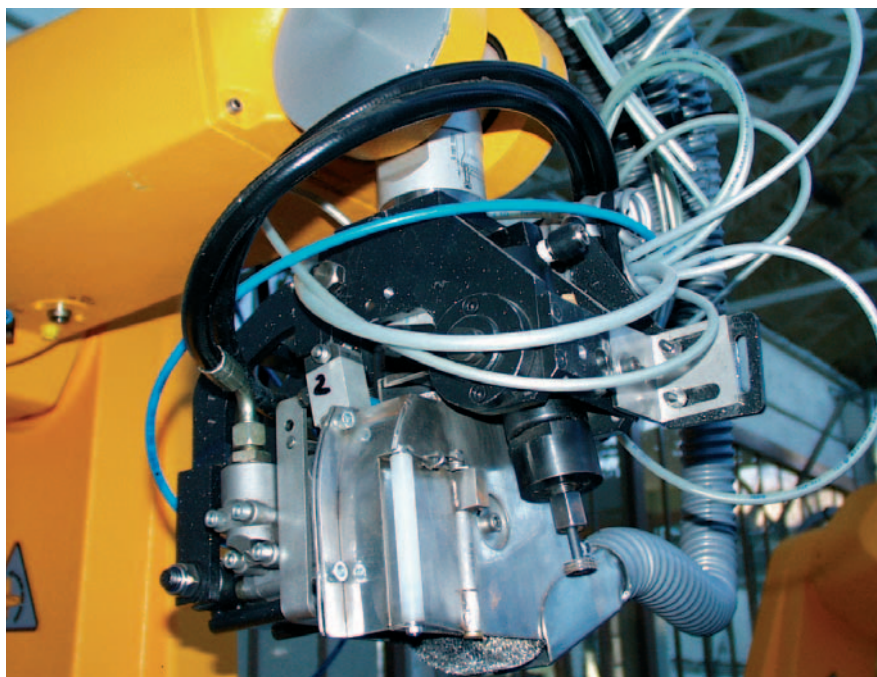


In the last issue of World Footwear, we looked at the use of robots in specific operations on PU direct moulded footwear. However, the use of robotics in a wider sense appears to have stalled in recent years. Mary Simons assesses the current situation and availability.

A future for Robotics

Interest in robots began decades ago when they were first introduced in engineering applications. In this situation, they were valued for the controlled consistency of action rather than for the labour-saving aspect that initially attracted footwear manufacturers. Early models offered very limited actions and, before they could be developed further, the idea of moving footwear production to low labour cost countries began to take hold. This diminished the incentive for the industry to actively seek ways of utilising and developing robots and it has been left to a select few companies to persevere with development.

By their nature, robots perform repetitive actions with unvarying precision, which does not always make them ideal for the manufacture of items using natural or variable materials. However, as robots have increased in sophistication the range of potential applications has increased. At a time when footwear manufacture is under pressure to minimise costs, this newest



Actis workstation for finishing

level of ability renders robotics worthy of a reassessment.

Development

A working definition of a robot might be 'a programmable machine' and, as such, the first robots in shoe factories were the simple pick and place units that we now take for granted.

They were mechanical devices which positioned a suction head on to a

component, picked it up, possibly turned it *en route* and placed it in a new location. Robots have come a long way since then and the latest models are capable of six axis movement allowing the complex 3D curvature of lasts to be followed with ease, in motions which replicate human movement (anthropomorphous robots). In addition, a range of interchangeable tools can be fitted to the head to perform a variety of tasks along the programmed path.

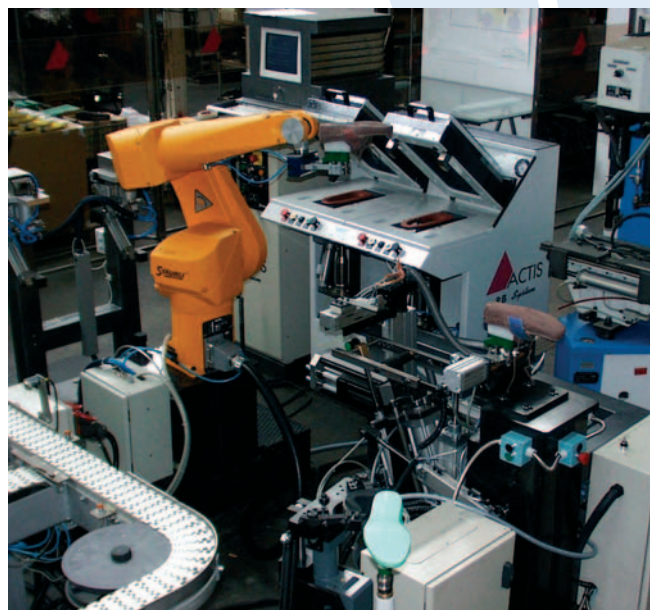
Programming the action was originally a difficult and time-consuming process. The advent of very powerful computers and specialised software has now speeded and eased this process beyond all recognition. Today's robots can often 'learn' from a sequence of manually controlled movements and these actions can then be automatically saved as a programme.

Capabilities and limitations

As robots only do what they are programmed to do, care is needed in selecting the optimum applications and designing their programmes. However, once set up they will not suffer from the variability associated with human operators and, as long as the work pieces



Pick and place device on an Elitron press


Actis communications centre

Actis automated sole attachment

continue to be presented consistently, can operate for long periods without attention.

Considered individually, some operations may not justify the investment in time and expense needed to change to robotics but may become worthwhile if included as part of an automated process line.

Operations such as forepart lasting, where the variability of materials requires the option of fine manual adjustments on individual work pieces, have been the subject of very sophisticated machine development and are not practical to replace by robots. In these instances, robots can still be used to present and remove work pieces in order to minimise manual labour.

Automatic handling and robotic operation forces discipline upon the scheduling of production and the supply of materials, and offers further associated benefits. It provides an opportunity to review and streamline stock control, purchasing, production scheduling, materials handling, storage and delivery procedures. As the location and status of each work piece is recorded at all stages, detailed feedback is readily available.

Applications

Specialist companies such as Actis and Robot System offer the footwear industry tailor-made systems for particular applications and have wide experience of different types of production around the world. The European EUROShoE project

brought together specialist equipment and software companies with machinery suppliers, such as Torielli and shoemakers such as Ecco, to develop and prove practical solutions for automated production. This has provided useful information for future industry-specific developments.

Cutting already has sophisticated specialist equipment to automatically process footwear materials. More automated machines feature automatic take off devices to deliver cut parts to, for example, rotary storage units from which they can also be automatically transferred for subsequent processes. Identity and stitch marking could also be automated if these have not already been performed during the cutting sequence.

Upper preparation processes such as matrix skiving could be roboticised with a human to set up and check machine settings. Unfortunately, as soon as individual work pieces need machine adjustments, as in conventional skiving, robots become unfeasible.

Upper construction applications are limited. With careful pattern engineering to maximise the number of operations performed flat, automatic stitching machines can be extensively used and, therefore, these could be loaded and unloaded robotically. In practice, human beings are currently still a cheaper and possibly faster option and can also simultaneously inspect the results.

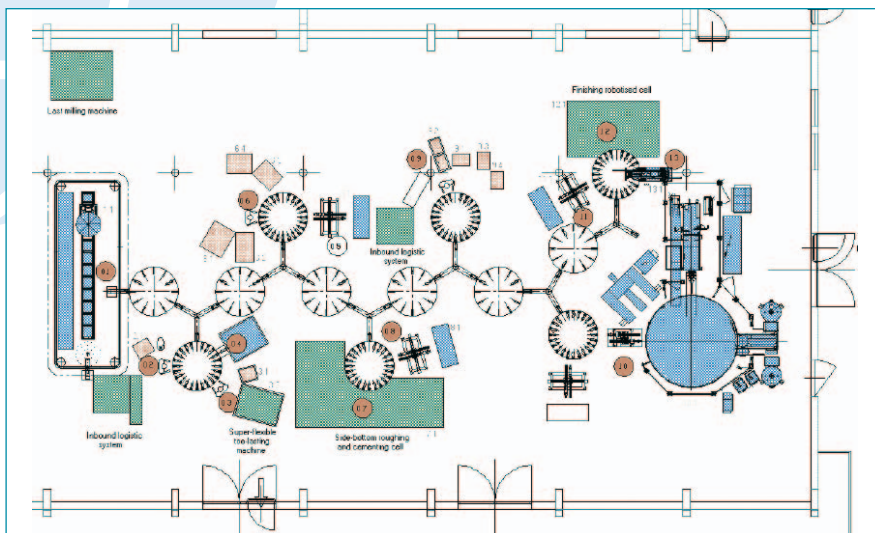
At some point in the process of constructing a conventional shoe upper,

a three dimensional shape has to be introduced by a seam and, as a result, subsequent operations are likely to be more efficiently performed by humans who can adapt their movements to each individual upper. Once the upper is complete, however, the opportunities for robotics again increase.

One of the early introductions of robots into normal flat lasted production was for one man lasting. Schön introduced a robotic device to offload a shoe from the forepart laster and transfer it to the linked automatic seat and side lasting machine. In this system the human operator is free to adjust the forepart laster controls if required and trigger its operation as normal. The seat and side lasting machine doesn't need this intervention, so all the human operator does is offload the finished shoe to check its quality.

Once the shoe has been lasted, preparation for sole attaching offers ideal conditions for robotics or automatic machines. If robots are to be used efficiently it helps enormously if the precise orientation and location of the


Fagus last plate



Factory layout by Torielli

last is known, as only then is there a fixed reference point to ensure optimum operation. This has been addressed by both Actis and Robot System (for ease of automated transport and robotic programming) and by Fagus (because of the reduction in set up time for direct moulding).

Fagus uses a metal plate precisely located on the top of the last. It is attached to the rough last which is then completely milled from the known point of the centre of the plate thimble. It includes the fixed location point and a patented locking mechanism to keep the last firmly locked during direct moulding and allow automated last breaking and closing.

Both the Actis and Robot systems use a micro-chipped plate on the top of the last which carries data about the last, the operations to be performed and the tooling required. These lasts are available from Fagus, Overstampi and Menard. Actis also offers an optional insert to provide automated last slipping. In this system, an operator places the 'bag' upper for force lasting on to the open last, where the backpart has been moved to shorten the last as shown in the image. The last is closed automatically, thus tensioning the upper. After the shoe has completed all the other processes on the automated making line, it returns this station where it is 'de-lasted' by the automatic last opening procedure. The same operator that loaded the upper now takes it from the machine and passes it on for socking and packing.

If more than one tool is required for an

operation, tooling in the robot head can be automatically selected and loaded at the appropriate point by a 'prehensor' device so even that aspect need not be controlled by a human.

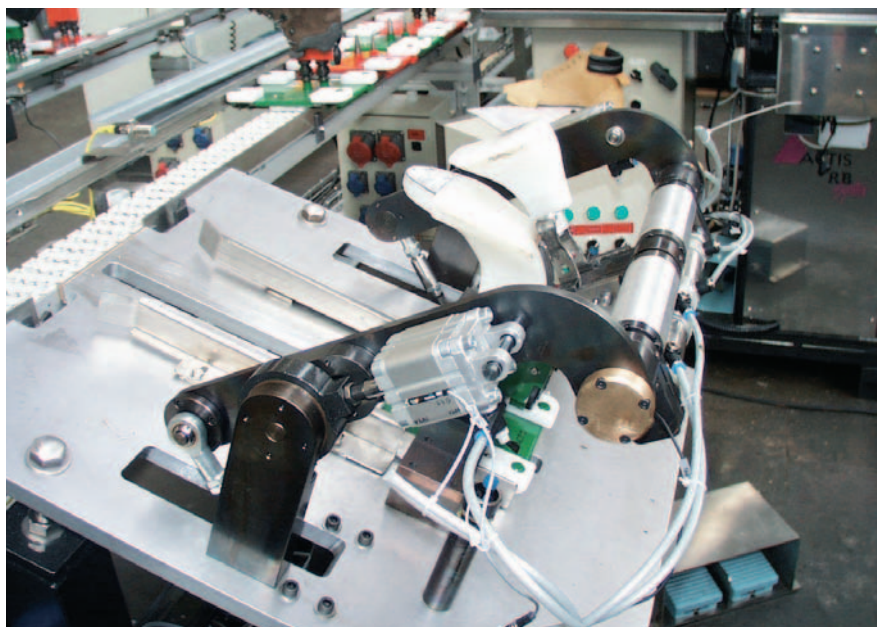
Numerous specialised making machines exist which include safe, effective extraction systems for dust and vapours and a good solution could be to load and off-load these robotically. Alternatively, robots can be programmed to perform the actual tasks themselves. Footwear manufacturers can move gradually into robotics by combining the two approaches. A production line for lasting, making and direct moulding was created by Torielli as part of the EUROShoE project and uses only four

operators and five robots.

Robot System offers a basic set up using three operators and one six axis robot to produce 720 pairs per shift. This uses a human to last the uppers, a robot to rough (including above the feather) and cement, and humans to attach the soles, slip the lasts and reload the rink. Where sole units are to be attached in a press, the human ability to manoeuvre the unit to achieve perfect positioning and fit often renders robots less suitable but given reliable sizing of units, Actis has achieved successful working installations using commercially available sole presses. However, if the sole is to be directly moulded on, then this offers an ideal situation to utilise robots. The specialised article by Klockner DESMA in the January/February issue of *World Footwear* covered these applications in detail.

The current position

Initial interest in high tech solutions waned when low labour cost countries began to offer the West an alternative way to keep down costs. Now increasing labour, energy and transport costs are beginning to cause concern for the future, and maybe the time is right to reconsider the economics of 24-hour automated production in the West. As CAD usage increases, so the basic data needed for automated production becomes routinely available. Further progress and options in the field of robotics are therefore likely to appear. 🌐



Actis automated last slipping