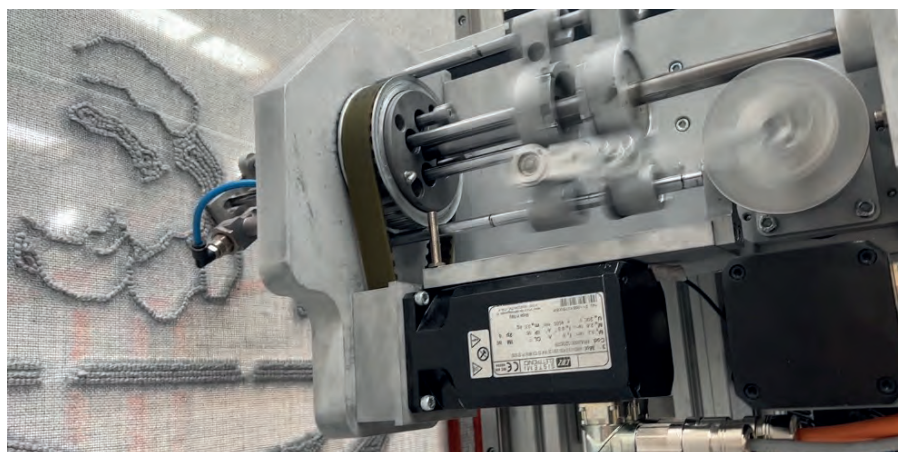


Tufting machine emulates Turkish carpet-makers' skills

Advanced control technologies including servodrives and bespoke software have been used to build a machine designed to emulate the expertise and traditions of Turkish carpet-makers. The machine was developed in a collaborative project by engineers based in both Turkey and Italy.



The high-speed robotufting machine is designed to emulate the expertise and traditions of Turkish carpet-makers

The Turkish carpet manufacturer SMM is using high-tech machinery to emulate the country's hand-tufting traditions. One of its machines is the Hybrid Robotuft machine, which has been designed to bring the capabilities of high-specification hand-tufting methods to a high-speed robotic tufting head.

To be able to use tough fibres such as silk and nylon, the machine needs a scissor-cutting system to push and cut the yarn, otherwise it would be limited to using standard materials such as wool and viscose. The scissor is a highly developed design integrating a special shape and hardened materials for precise, high-speed operation and durability. The pitch of the scissor can be adjusted to achieve the best tufting quality for all types of yarn.

To produce low pile heights it is necessary to achieve precise synchronisation and accurate cutting using bespoke machine parts. These components have been developed using a combination of experience and sophisticated CNC techniques. With previous technologies, it had not been possible to produce pile heights of less than 13-14mm.

An automation system and motion software were needed to operate the

tufting head. A standard CNC system would not be suitable for this application, and because the tufting process is so specialised, custom-designed motion software had to be developed.

This software has been designed to simulate the capabilities of hand-tufting experts in a high-speed, automated environment. The machine controller has to apply human operator parameters to calculate the necessary stitches. The software written to emulate the actions of hand-tufting experts includes the capabilities for: on-the-fly co-ordinate setting; automatic yarn feeding; as well as mixing yarns and changing tuft densities. This is the first time that these parameters have been calculated mathematically and interpreted as software algorithms. A special look-ahead function had to be developed for the application.

It is possible to change all of the tufting parameters online while the system is running. The dynamic response can be adjusted to achieve movements from slow to fast, depending on the requirements of the design. Stitch lengths are calculated automatically to make a stitch at each corner. Turns can be adjusted to create smooth corners, or sharp corners produced using slower speeds. In a yarn breaks,

interpolation can be put on hold then moved forwards and backwards to restart a pattern at the required point.

The performance of the robotufting process depends on the capabilities of the design software. The software needs to integrate all of the required tufting parameters and to operate with similar capabilities to skilled hand-tufting experts. New vector-based design software has been used to simulate the hand-tufting capabilities.

The carpets are designed on a screen that allows all of the necessary tufting parameters to be specified and controlled. CAD/CAM (computer-aided design and manufacturing) functions are used, and special functions have been developed to create the robotufting patterns as easily as possible.

The application was developed by the Italian motion control specialist CMZ Sistemi Elettronici – which is part of the Soga Energy Team industrial group – working with the Turkish systems integrators, Argeta and CMD. The tufting machine uses CMZ's new-generation SBD servodrives as well as its MMD servomotors.

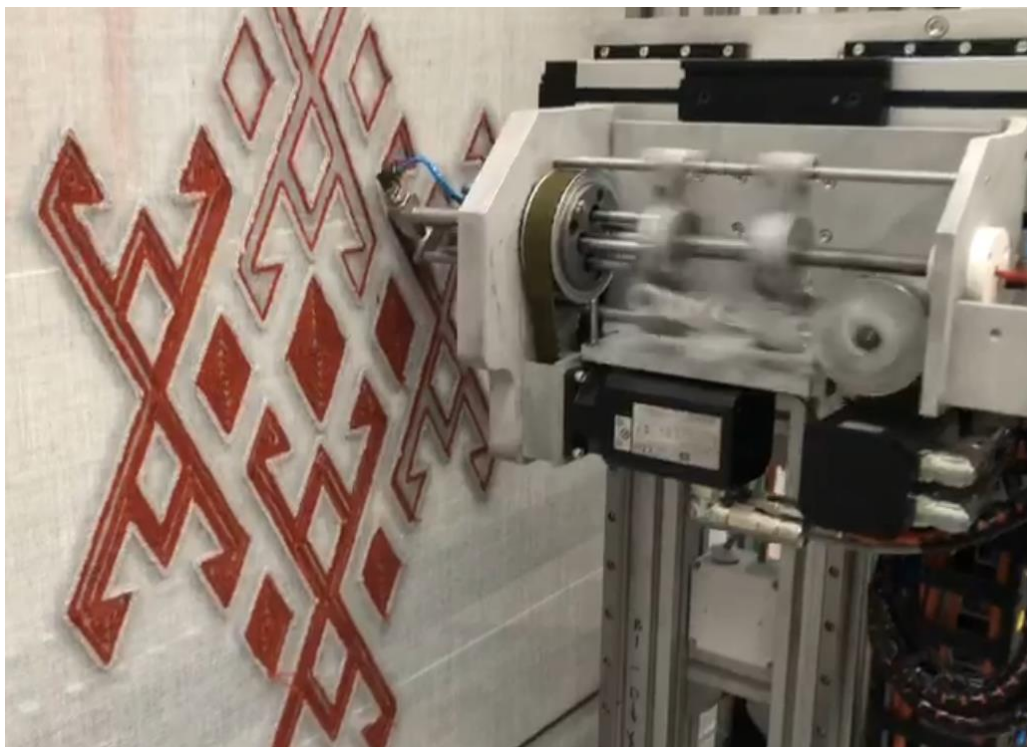
The eight-axis control application was developed for CMZ's modular, Codesys-based FCT640 motion controller which uses EtherCat communications. Because of the machine's high-speed operation and heavy-duty working cycles, the control components were chosen for their ability to operate non-stop with long operating lives and low maintenance. ■



Carpets are created on a screen using specially developed software that allows designers to specify all of the necessary tufting parameters



*The robotufting cabinet with CMZ **FCT640** motion controller and **SBD** brushless servodrives*



Specially designed Motion Control system (hardware+software) for carpets tufting machines perfectly emulating hand-tufting Turkish excellence