

HEIDENHAIN'S LATEST CONTROL ENHANCES THE CAPABILITY OF MILL-TURN CENTRES

Joint Heidenhain / Hermle seminar at the NAMRC featured A-axis Turning, Adaptive Feed Control and Active Chatter Control

A group of over 50 production engineers from manufacturing companies within a two-hour drive of Rotherham attended two one-day seminars at the NAMRC (Nuclear Advanced Manufacturing Research Centre) on 20th and 21st May 2015. The purpose was to explain the substantially improved metalcutting possibilities on a Hermle machining centre with integrated turning capability when the machine is fitted with the latest TNC 640 contouring control system from Heidenhain.

Jointly sponsored and organised by Heidenhain (GB) and Geo Kingsbury, sole agent for Hermle machines in the UK and Ireland, the event was also supported by CAD/CAM specialist Delcam, tooling supplier Seco and workholding firm, Schunk.



Heidenhain and Hermle head offices and factories are located in southern Germany and the companies have had a close working relationship for many years. Evidence of this was the agreement between the control producer and the machining centre manufacturer whereby Hermle had one year's exclusivity on fitting the TNC 640 to machining centres that incorporate integral turning. Hermle had a marketing advantage for that period, while Heidenhain benefitted from the machine manufacturer's knowledge and expertise. They enabled the capabilities of the CNC system

to be refined, particularly with regard to conversational programming and kinematic control of turning functions.

The fruits of the collaboration were communicated to attendees at the NAMRC over the two days. The programme included classroom presentations and computer simulations of various machining cycles followed by live demonstrations on a Hermle 5-axis C 60 U MT. It is an agile machining centre with 50 m/min rapids and 6 m/s² acceleration in the linear axes, despite being capable of producing parts up to 1,200 mm diameter by 900 mm high. The MT suffix signifies that the machine incorporates a torque motor-driven table on the trunnion for in-cycle turning.

A 1.6-tonne EN8 billet measuring 815 mm in diameter underwent a complex series of machining operations at the seminars, while cameras placed within the machine transmitted videos to enable visitors to appreciate the nuances of what they were seeing. Most demonstrations involved cutting dry to assist observation; only deep-hole drilling was executed with 150-bar through-spindle coolant.



Many features of the machine and control combination were presented, three of which are worthy of special mention. One was 'A-axis Turning', which allows the trunnion to be continuously positioned at any angle while the component on the table is rotated for turning using a fixed tool in the spindle. The merits of this simultaneous interpolation to improve cutter access and allow shorter turning tools to be used for more stable machining were readily appreciated by the audience.

Another attribute demonstrated was programmable 'Adaptive Feed Control' within the TNC 640, which continuously adjusts the feed rate to keep the spindle load constant as the milling cutter moves into different parts of a cycle. So when particularly heavy metal removal is in progress, the infeed slows, whereas during periods when the spindle load is low, such as when the tool is changing direction, the feed rate is raised. AFC can significantly shorten cycle times and in the example given at the seminar, a 17 per cent reduction was recorded.

A further function in the TNC 640 is trochoidal milling, whereby a tool spirals in to take a cut wider than the diameter of the mill. Spindle load is reduced when metal is removed in this way, so the full depth of the cutter flutes can be used rather than just the bottom few millimetres, leading to faster metal removal and longer tool life. A demonstration in titanium alloy (Ti64) using a 16 mm diameter solid carbide end mill showed that trochoidal milling increased metal removal rate by one-third, while if AFC was applied as well, the increase was nearly two-thirds.

The third highlight was 'Active Chatter Control', which allows depth of cut to be increased by up to 20 per cent when roughing without inducing vibration. ACC is achieved not by altering the cutting data, but by varying the output of the feed drives. Apart from enhancing productivity, benefits include less tool wear, reduced machine loading and higher process reliability.

Unfortunately, it proved impossible to generate any chatter on the 30-tonne Hermle C 60 U MT, so it was possible only to simulate the feature but not to show it in action. As an adjunct to this demonstration, for efficient metal removal over larger areas, Delcam's Vortex software was presented.

Richard Kingsbury, managing director of Geo Kingsbury commented, "We are very grateful to the NAMRC for hosting the event, to Heidenhain (GB) for co-sponsoring it, to the other equipment suppliers involved and to Martin Wener, Hermle's Regional Sales / Key Account Manager, who travelled over from the company's headquarters in Gosheim. It really was a team effort."