Introduction

Many organisations these days have a large and complex array of systems available for designing, digitising, milling and measuring. Interaction between the different manufacturers systems with their differing formats is highly desirable but can be bound up with numerous small or big problems. However their functions have to be combined to ensure a smooth exchange of data.

At Isel Automation KG (Germany) high-tech reverse engineering systems have been devised that meet individual machining requirements specified by the user. A typical system (Figure 1) comprises:

- Isel’s CNC milling machine;
- conoprobe laser sensor (from Optimet, Israel);
- surface feedback and analysis software (PointMaster, from Knotenpunkt, Germany);
- CAD/CAM software (ISY v2.0, from Schott Systeme, Germany).

The laser sensor

For non-contact scanning of 3D free form surfaces, the Conoprobe comes into action.

Conoprobe is a revolutionary system for non-contact three-dimensional measuring. The system, protected by nine patents, is based on the technology of conoscopic holography that makes possible extremely precise 3D digital pictures of almost all surfaces, even on surfaces that are considered most difficult to measure (such as black, red, or shiny surfaces). The advantages of the new technique are in high speed data acquisition and high measurement resolution, a combination previously considered as not attainable.

With the digitizing package, different ranges or accuracies can be chosen, depending on the type of laser sensor and material. By means of a double Z-axis feed and a measuring range of 16mm for example, an absolute accuracy of 6μm is attainable; with a measuring range of 70mm an absolute accuracy of 15μm. A major advantage of the laser is that it can be used for a range of measurement applications: simply by attaching different lenses the range of measurement can be extended or reduced to suit each requirement. Conoprobe measures a
wide variety of surfaces which previously could not be measured by non-contact methods, such as machined metals, or other relatively shiny objects (Figure 2). It also has no problems measuring surfaces containing a number of different reflection characteristics. Thanks to its design and measuring method, the laser also measures narrow and deep holes of diameter less than 1mm and a depth to diameter ratio of 25:1. The parameters for scanning are set in the installed “PointScan” software. In that process, the scan speed, the resolution in X- and Y-axis as well as the XYZ digitizing range have to be defined. The digitizing system can easily be mounted on the full range of Isel CNC machines with servo motors.

The machine

Once a 3D form has been digitized with this machine, the sorted points, resulting from that process, can be transformed to bezier and triangular faces by the surface feedback software SurfaceExplorer. After that, these faces can directly be taken over into the CAD/CAM system “isy”. Here, the data can be processed and – within the CAM module – the milling paths for the Isel machine can be generated.

The same machine that is used for digitizing can also be used for milling the mould. The travel strokes of the machine systems (with servo motor drive) are from 440 × 300 × 160mm up to 2,700 × 1,500 × 300mm. In addition, the systems can be extended by tool changers, cooling devices, rotary axes, different spindle motors and so on.
The software

The “heart” of the digitization is the “SurfaceExplorer” software (Figure 3). The sorted points, produced with the software “PointScan” can be imported in SurfaceExplorer and worked over again with different procedures, so that one gets a 3D CAD data set for a further treatment in isy CAD/CAM or even for other CAD systems.

Full functionality is included:
- shifting, rotating, scaling and moving points to zero level;
- cutting in the XYZ direction;
- smoothing;
- peak filtering;
- all conceivable view functions;
- shaded representation;
- project management;
- analysis functions by automatic comparison of set and actual value of bezier and triangular faces with the digitised sorted parts.

Data transfer of the bezier and triangular faces to the isy 3D CAD/CAM software is provided in addition to transfer to other 3D CAD formats like DXF, STL, IGES and VDA-FS.

The production process is completed with the full CAM module of isy CAD/CAM. In this powerful module, rough and smooth cycles (contour orientated) will be created directly by parameter input and installed in the machine (Figure 4).

This interaction of the laser digitisation, the surface feedback and the CAM integration in combination with an Isel CNC machine is, as a system, unique.

Established four years ago in Israel, Optimet was formed by Ophir Optronics Ltd and a team of highly esteemed authorities in the field of conoscopic holography. The company has two subsidiaries for marketing and technical support, one in the USA and one in Japan.

Spectrum Metrology is the exclusive UK technical agent for the Conoprobe and will be pleased to demonstrate this revolutionary technology by measuring your component for you (the Conoprobe can be supplied individually for integration, or as a measurement station with positioning stage and software). Please contact Graham Anderson or Peter Seddon on +44 (0) 116 235 8355; Fax: +44 (0) 116 235 8344; E-mail: SpectrumMetrology@compuserve.com; Web site: www.spectrum-metrology.co.uk

Figure 3 Surface analysis with the SurfaceExplorer software
Figure 4 Milling path simulation with isy CAD/CAM