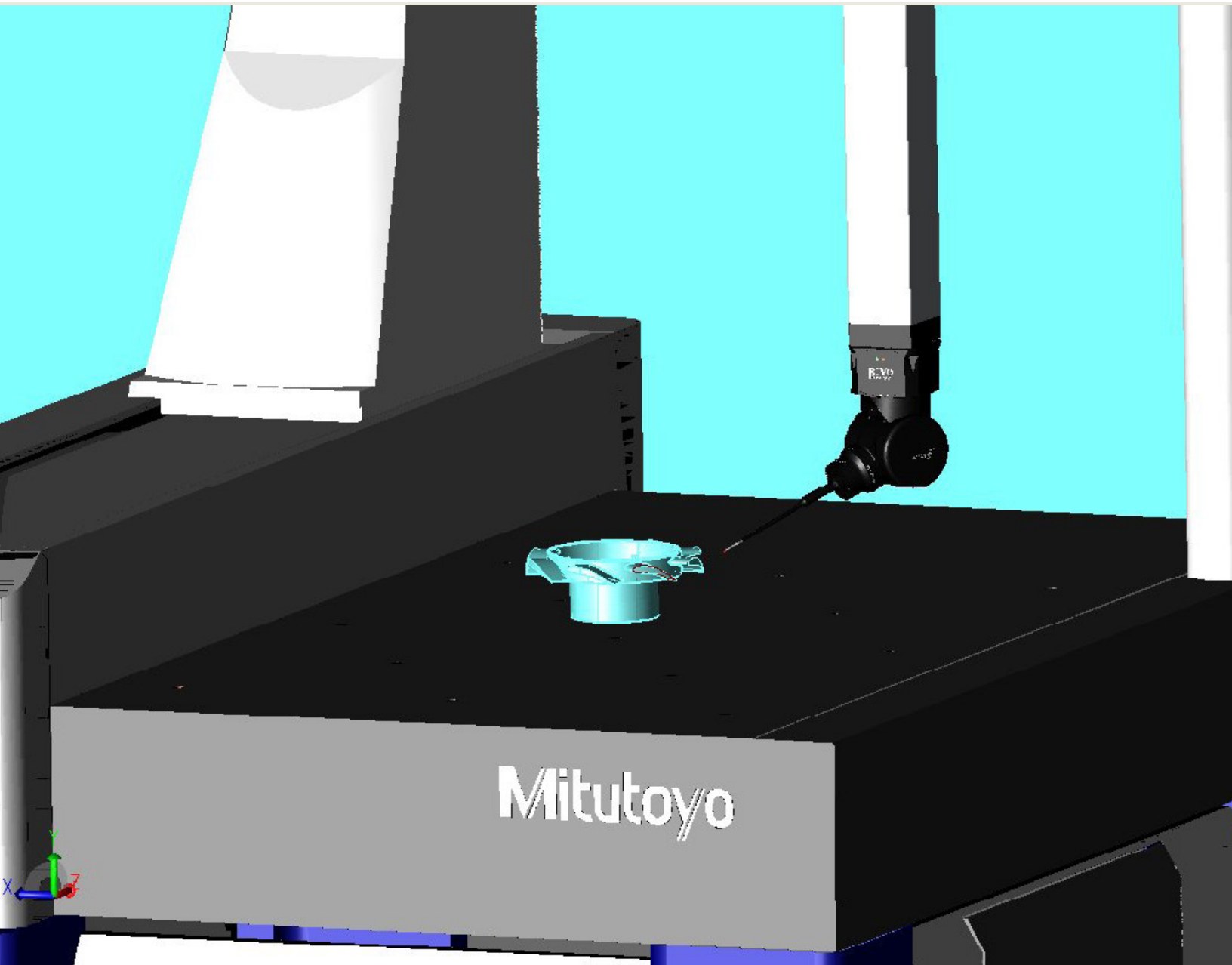# MITUTOYO

Mitutoyo is the leading metrology company in the world with a full range of dimensional measurement tools, instruments, and systems. Its MCOSMOS coordinate measuring machine (CMM) software is the industry standard in the jet engine market.

Mitutoyo

Challenge:

Mitutoyo's customers measuring free form surfaces required accurate 3D models. The company needed 3D modeling and translation capabilities to be competitive, but proved unsuccessful in developing their own IGES translators.

Solution:

Spatial's 3D ACIS Modeler selected in 1994; subsequently integrated 3D InterOp for its high-end CAD data translators, and HOOPS Visualize for more robust graphics functionality.

Results:

- MCOSMOS software has become a huge success with Spatial technology

- Mitutoyo has positively influenced Spatial product development (product manufacturing information to specify tolerances)

- Mitutoyo has broadened the use of Spatial 's software development toolkits to other parts of the organization, such as machine configuration

MITUTOYO

In business for 82 years, Mitutoyo has become the leading metrology company in the world with a full range of dimensional measurement tools, instruments and systems. Its MCOSMOS® coordinate measuring machine (CMM) software is the industry standard in the jet engine market. By combining highly intuitive, icon-based programming with the ability to import native CAD models, MCOSMOS enables even novice users to easily import part and fixture models and place them, on- or off-line, in a CMM.

MCOSMOS is versatile software used in a variety of applications. Mitutoyo's two largest customers - Rolls Royce, and Blades Technology Ltd., as well as GE, Pratt & Whitney, and Lufthansa – use the CMM software to check high precision machined parts such as turbine blades against specifications throughout each phase of the manufacturing process. At the other end of the spectrum, artists at companies such as Playmobil and Lego use MCOSMOS to construct toy parts by digitizing a design model with MCOSMOS and making the plastic forms from the results. Other applications include automotive body parts and marine engineering.

CHALLENGE

Mitutoyo's customers needed to evaluate free form surfaces, so the company first tried to develop IGES translation capabilities internally but wasn't obtaining satisfactory results. It realized that to be competitive it needed superior 3D modeling and translation capabilities. Mitutoyo developers excel at creating software that manages part programs and evaluates the coordinate data in specifications against the CAD models, but it lacked the expertise to develop a geometry modeling engine and CAD data translators internally.

SOLUTION

MCOSMOS provides an advanced 3D surface-analysis program for comparing measurement data from three-dimensional surfaces with nominal data generated from a CAD model and works by graphically defining the CMM, racks, probes and styli. Selected graphically, all measurement points are clearly displayed on a 3D graphic view, which can be rotated, zoomed or panned to any convenient viewpoint. Animation enables offline running of part programs before placing an actual part in the CMM, providing machine access verification and collision avoidance.

Using MCOSMOS, online and offline geometric programming eliminates traditional manual data inputting - data is automatically extracted from the CAD models, wireframe or surfaces with just a few icon-clicks to generate CMM part programs, even before the part is manufactured.

Back in 1994 when initially designing the functionality for MCOSMOS, Mitutoyo product managers realized they lacked the experience and manpower to develop the underlying modeling engine to support working with its customers' CAD modeling data.

> "Spatial is essential to our software and have continuously met our expectations. Without it we couldn't be competitive in the CMM market."
>
> — Dr. Ing. Dieter Loebnitz
> Director Software Development
>
> Mitutoyo

Its customers were measuring free form surfaces such as turbine blades which aren't described by any basic geometry. Initially the company was doing the translation internally and tried to display measurement results with its own tools, but it proved to be unsatisfactory. It created a market research survey to analyze third party tools to accomplish this and came up with three possibilities – Open Cascade, Parasolid and Spatial with its 3D ACIS Modeler kernel. With Spatial, Mitutoyo found that Spatial had the best CAD integration, graphical reporting and display. "Something comparable was not available from any other company which is why we decided to choose Spatial," says Dr. Ing. Dieter Loebnitz, Director Software Development at Mitutoyo.

MCOSMOS undergoes continuously ongoing development with new releases every year or two with added functionality, different probing strategies and measuring features, all determined by customer input. More than ten developers (in Germany and Los Angeles) directly work with 3D ACIS Modeler-related aspects of the program.

Thanks to Spatial's comprehensive 3D InterOp software development toolkit, MCOSMOS accepts IGES, VDA-FS, and STEP CAD formats; as well as Spatial's 3D ACIS Modeler and UGS's Parasolid. HOOPS Visualize is used for all of the software's graphical reporting, such as color shaded services to depict deviations from the ideal model.

RESULTS

Throughout the years, Loebnitz has seen many benefits to incorporating Spatial's technology into MCOSMOS, including the ease of programming measurement sequences for its CMMs. In addition, HOOPS provides Mitutoyo's users elegant visualization of measurement data and graphical reporting.

What aspect of Spatial's technology has proven most critical to the success of MCOSMOS? Loebnitz points to the efficiency of the 3D InterOp translators, the speed of which have improved quite a lot over time, in terms of display time, especially important with today's models that are measured in gigabytes rather than megabytes. Large models that used to take a few hours to be read in, now take mere minutes.

Future functionality will include adding product manufacturing information such as tolerance information from the CAD model to the CMM, which wouldn't be possible without Spatial. Loebnitz credits its close partnership with Spatial as instrumental to making this possible. "This is a new development that has great future potential for us," notes Loebnitz.

Mitutoyo was so pleased with the results of integrating Spatial technology into its CMM software that it recommended its use in other parts of our company. For example, in machine configuration, Spatial facilitates having a complete offline system where the user can simulate the process of measuring. This provides a huge cost savings because the user can make measurement sequences using the CAD model prior to the actual part being manufacturing. So the machine is busy measuring and not programming parts.

For offline programming Mitutoyo uses Spatial's 3D ACIS Modeler and HOOPS Visualize. For the complete simulation the operator needs to visualize the rest of the machining to see how the machine moves, for example where it changes its tools. Without Spatial's technology, to show this sequence, the user would have to construct his own machine. Mitutoyo's Machine Builder, a CMM configuration program, allows the user to use his machine as a model and place the CAD model of the part on it for programming and simulation, saving time and money. Spatial components are at work in other areas as well. For example, Komeg, a subsidiary of Mitutoyo, is using Spatial's technology to construct fixtures for mounting workpieces. The opportunities to utilize Spatial technology within Mitutoyo are limitless.

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DASSAULT SYSTEMES | The **3D**EXPERIENCE® Company

U.S. Spatial Headquarters
310 Interlocken Parkway
Suite 200
Broomfield, Colorado
80021
USA

Spatial EMEA Headqouarters
Altenkesseler Str. 17/B6
D-66115
Saarbrücken
Germany

Spatial ASIA Headquarters
c/o Dassault Systemes K.K.
ThinkPark Tower, 2-1-1 Osaki,
Shinagawa-ku, Tokyo 141-6020,
Japan