The Japan Society for Precision Engineering

Introduction of JSPE PRIZES 2012

1. Yoshimi Takeuchi (CHUBU UNIVERSITY)

Dr. Yoshimi Takeuchi has studied machine tools and manufacturing systems for many years. His pioneering work includes the research and development of CAM systems, ultra-precision microcutting, and the control of multi-axis machine tools. He is one of a select group of researchers who have established the origins of these research areas. He has made significant contributions to the innovation of ultra-precision machine tools and multi-axis machine tools. Recently, he proposed dexterous machining for a complicated shape with nested structures. For the above research achievements, he has received many best paper awards, technology awards, achievement awards, etc., from the Japan Society for Precision Engineering, the Japan Society of Mechanical Engineers, and other societies and foundations. In addition, he has contributed to international academic activities as the editor-in-chief of Precision Engineering and the International Journal of Automation Technology, and the chairman of several international conferences. He served as a committee chairperson of the Science Council of Japan and as a vice-president, and the chairman of the Kansai branch, as well as a director and fellow of the Japan Society for Precision Engineering. As described above, Dr. Yoshimi Takeuchi has made distinguished contributions to the development of many areas related to precision engineering. Thus, his achievement is enormous.

Fig. 1 JSPE PRIZE winner speech (Dr. Yoshimi Takeuchi)

2. Shoji Ikawa (JTEKT CORPORATION)

Mr. Ikawa joined the Toyota Motor Corporation in 1975. Since then, he has been consistently taken on the development of manufacturing technology. He has contributed to in-house production faculties, such as automated machine tools and assembling machines and has developed simultaneously controlled three-axis machining systems. He played a part in winning the Okochi Memorial Technology Prize for the paper entitled "Development of practical use of a flexible manufacturing system for medium variety and quantity" in 1988, and won the Okochi Memorial Production Prize for the paper entitled "Development of an automatic inspection system of engine functions by monitoring technology" in 1999.

He has played an important role in the development of automobile manufacturing technology in a wide variety of fields, such as the production of dies/molds, and plastic working, by developing new CAD/CAM and processing technologies (gear rolling technology, the simultaneous rolling of spline shafts with different diameters, abradable welding, and nylon reaction molding, to name a few). In addition, he has made an effort to globalize and standardize the manufacturing cell line, automate the assembly line, avoid waste, etc.

He has been very active in The Society for Precision Engineering, The Japan Society for Die and Mould Technology, The Japan Society for Technology of Plasticity, and other organizations. He served as the president of The Japan Society for Die and Mould Technology in 2002 and 2003 and of The Japan Society for Technology of Plasticity in 2008. He is also a fellow of The Society for Precision Engineering.

As mentioned above, Mr. Ikawa has made outstanding contributions to the development of manufacturing technology in the automobile industry and the expansion of societies, and associations.

Introduction of JSPE Technology Awards 2012

1. Development of low-cost spindle unit with highly efficient spindle shaft cooling system ensuring high accuracy and high rigidity

Shoichi MORIMURA, Ryoichi SHIMOMURA, Hideto KATO, Tatsuhiro YOSHIMURA (Okuma Corporation)

For machining dies/molds and high-precision parts, a main spindle unit that allows both highly accurate machining and heavy-duty cutting is essential. However, it has been difficult to provide such a spindle unit because of the heat that accumulates in the spindle. Although a "spindle shaft cooling technology" to directly cool the inside of the spindle

was being employed as a measure against heat, its initial and running costs were high. Against this background, we developed a new, highly efficient spindle shaft cooling technology that could be used at lower initial and running costs and integrated with the spindle unit. A distinguishing feature of this new spindle shaft cooling technology is that only the front bearing, which causes thermal deformation of the spindle or the tip of a tool when heated, is cooled, while the motor and rear bearing are not. Because no unnecessary cooling is applied, its initial and running costs are kept down. Furthermore, more highly accurate machining by a much more rigid spindle is achieved by using the limited cooling capability of the oil controller only for essential areas. This spindle unit is currently available at our MP-46V vertical machining center for high-precision parts and die/mold applications.

Fig. 2 Highly efficient spindle shaft cooling technology

2. Development of Process Design Support System by High Speed 5-axis Machining Simulation

Yoshihiko YAMADA , Toshiyuki OKITA , Hiroyuki NAKANO, Hiroyuki TSUSAKA (JTEKT Corporation), Yoshimasa KUWANO (Toyota Central R&D Labs.,Inc.)

In recent years, because of the intensified global competitiveness in die machining, a further reduction in the lead time, lower costs, and higher accuracy are in demand. 5-axis machining is receiving attention as a means to solve these issues. Tilting the tool orientation opens up the possibility to use highly rigid tooling throughout a wide scope, which results in shorter machining time and usage of fewer tools. However, in contrast to the conventional 3-axis machining, complex mental tasks such as determining the tool orientation while considering interference are required in the process design phase prior to machining, which not only places pressure on even those experienced workers, but also consumes a significantly larger amount of time than that required for the actual machining itself.

Accordingly, with the aim of shortening the overall lead time from the machining process design to the machining itself, we developed a support system that enables highly efficient indexing 5–axis machining process design in a short time, even for inexperienced workers.

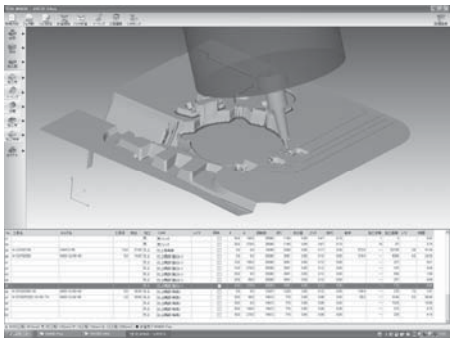

Fig. 3 Screenshots of the support system

3. Development and Practical Use of Automatic Generation System for Assembly Animation and 3D Work Instruction Sheets Based on "Dynamic Exchange Disassembly Order Algorithm"

Atsuko ENOMOTO, Daisuke TSUTSUMI, Bayasi QIQIGE, Kiichiro IIDA, Toshiaki SHIBATA (Hitachi, Ltd.)

With the globalization of manufacturing activities and increasing diversification of product models, animated work instructions for assembly sequences have been increasingly employed to assure product quality. However, assembly sequence planning and the subsequent animation editing time increases drastically and become unacceptably time consuming, on a factorial order, as the number of assembly parts increases. To address this problem, a fast assembly sequence and assembly motion generation method have been developed based on the assembly part constraints and part layout in CAD assembly models. The generated assembly sequences are then automatically translated into animation scripts and eventually employed as animated work instructions in actual manufacturing sites.

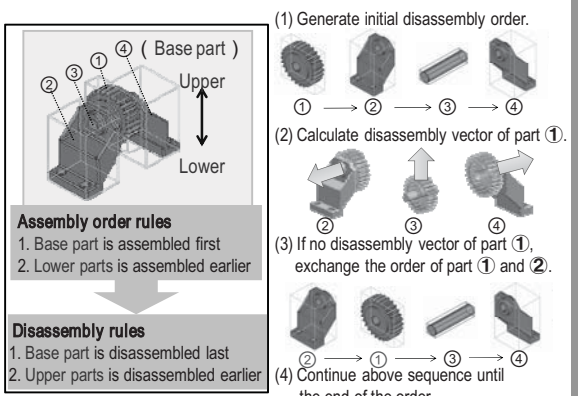

Fig. 4 Dynamic Exchange Disassembly Order Algorithm