



The Japan Society for Precision Engineering

Introduction of JSPE PRIZES 2017

1. Kazuo SATO (*Aichi Institute of Technology*)

Dr. Kazuo Sato has dedicated his career as a researcher to developing micro-nano-scale mechanical science and technologies based on the physics and chemistry of single-crystal silicon, a key material for micro-electro-mechanical systems (MEMS). Dr. Sato has thereby innovated several mechanical systems. In the 1980s, his works on silicon-based micro-devices, such as thousands of micro-wells for cell cultures, inspired many other applications for blood viscosity diagnoses, MEMS sensors for acceleration meters, and atomic force microscopy probes. In 1989, he won the Japan Society for Precision Engineering (JSPE) technology award for his work on MEMS. His academic research on anisotropic etching of single-crystal silicon has provided practical information for industrial development of a simulator based on a unique database to realize micro-three-dimensional structures. In addition, he organized an international collaboration of researchers through which the mechanism of anisotropic etching of single-crystal silicon was clarified. Moreover, he developed a tensile and bending test method for a specimen of a few microns thick on a silicon chip. Accordingly, he showed that the stiffness and fracture behavior of silicon of a sub-micron thickness or a few microns thick are drastically changed by the size effect on mechanical properties of the micro-specimens. It was determined that a boundary slip frequently occurs, even at temperatures less than 500 °C. In addition to technical papers, Dr. Sato has published technical books, text books, and practical guides on etching technology. Among his professional activities, he has been an active participant in numerous educational and engineering societies, especially those promoting MEMS and micro-nano engineering. He has served as a JSPE vice-president and board member, and chaired its annual conference in 2010. He has continued to strive to develop precision engineering in academia, industry, and education through his research in micro-nano-mechanical engineering and science.

2. Kenichi NAKAMURA (*Nakamura-Tome Precision Industry Co.,Ltd.*)

Since joining Nakamura-Tome Precision Industry Co., Ltd. in 1971, Mr. Kenichi Nakamura has been an active contributor to the field of machine tools. He has



Fig 1. Prof. Kazuo SATO (right)

introduced innovative machine tools to the market as a pioneer of "multi-tasking machines" that can perform various kinds of machining, such as turning and milling, especially with a single machine. Owing to his significant industrial contributions, he was awarded the Medal with Blue Ribbon in 2004. From 2007 to 2013, he was the chairman of the Japan Machine Tool Builders' Association and drove the machine tool industry. During his tenure, he raised important issues to development engineers, and he planned a human resources development program on advancing staff knowledge and skills in advanced science, technology, and technical group leadership. Among these efforts, he organized the Top Seminar by Machine Tool Manufacturers in which science and engineering student engaged in state-of-the-art machine tool technology to foster students' academic and professional interest in manufacturing and machine tool industries. His seminars have promoted the appeal of machine tools and precision engineering to universities and societies. In 2013, Mr. Nakamura was awarded the title of Fellow from the Japan Society for Precision Engineering. In 2014, he served as chair of the 15th International Conference on Precision Engineering (ICPE 2014). He helped lead the conference with various programs, such as facilitating novel scientific technology papers and incorporating aspects of traditional Japanese culture. He also greatly contributed to the development and internationalization of the conference. Overall, he has made tremendous contributions and achievements in the development of the machine tool industry and production processing technology.



Fig 2. Mr. Kenichi NAKAMURA

Introduction of JSPE Technology Awards 2017

1. Development of precise segmentation technologies for X-ray CT volume of assembled objects and its practical applications

Hiromasa SUZUKI, Yutaka OHTAKE, Yukie NAGAI (The University of Tokyo), Jun HOTTA and Mitsuhiro MATSUKAWA (Zodiac corp.)

Demand for reverse engineering using industrial X-ray computed tomography (CT) systems has been increasing. This technology enables very efficient segmentation of three-dimensional CT images of a mechanical assembly composed of many parts. The method employs a novel hierarchical representation of image segments based on a mathematical concept of the Morse complex defined on the norm of the image gradient field. Moreover, surface meshes of the components are extracted with a sub-voxel accuracy. A commercial system was developed using this technology with an intuitive user interface.



Fig 3. Segmentation of a mechanical assembly

2. Development of cutting tools for Ni-based superalloys for turning

Kaname SUEHARA, Hiroshi TAMURA, Shojiro TOMA, Yuuzoh FUKUNAGA (Mitsubishi Hitachi Tool, Ltd.), Shuho KOSEKI (Hitachi Metals, Ltd.)

This research aims to develop cutting tools for turning applications of Ni-based superalloys. We investigate the wear modes of tool edges using several analytical techniques. We specifically focus on observing plastic deformation of the tool materials and coating. We then develop tool materials with mechanical properties that improve at high temperatures. The output of this research includes a new cemented carbide doped with several elemental additives, microstructured CVD coating, and tool shape that exhibits low cutting force when machining superalloys. The tool material, tool shape, and coating enhance the stability of superalloy machining, and can be used for applications including aircraft and power generator components.

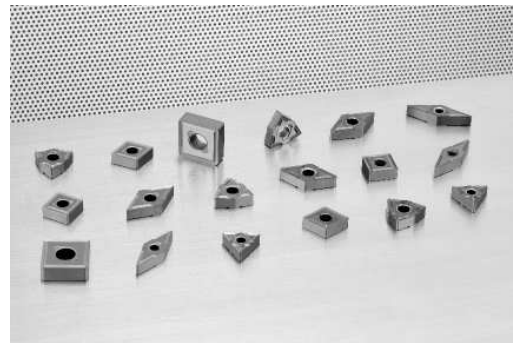


Fig 4. Photo of the developed cutting tools

3. An elevator renewal survey system utilizing three-dimensional measurement data

Takahiro NAKANO, Yuta YAMAUCHI (Hitachi, Ltd), Yoshiyasu SHIBUKI (Hitachi Building Systems Co., Ltd), Takashi HIRANO (Hitachi Mito Engineering Co., Ltd), Erdos GABOR (Hungarian academy of sciences)

Elevators established during the period of high economic growth are increasingly in need of renewal. Conventionally, an operator manually measures the dimensions in the renewal client's elevator shaft; with these data, an installation drawing is created manually. These operations are time consuming; therefore, we develop a technology to automatically generate an elevator shaft installation drawing from three-dimensional measurement data obtained in an on-site survey. We apply this technology to renewal project and reduce the number of labor-hours required for the survey and installation drawing, which are necessary for estimating renewal construction.

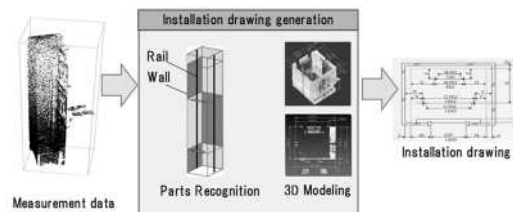


Fig 5. Installation drawing generation method