

【Grant-in-Aid for Scientific Research(S)】
Science and Engineering (Engineering D)



Title of Project : An Advanced Integrated Mother Machine System (AIMS) and Formulation of Machine Tool Engineering Based on the Development Process

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Research Area : Mechanical Engineering, Manufacturing Science and Machining Theory

Keyword : Ultra-precision machining, Nano and micro machining, Machine tool

【Purpose and Background of the Research】

Demands for three-dimensional nano-machining over a large range have recently increased in a variety of industries. In particular, ultra-precision machining has been required for form generation of large hard-to-machine materials. Although many studies on ultra-precision machining have been performed so far, there were only few studies on nano-machining of large and hard workpiece. This project aims at developing an advanced integrated mother machine system (AIMS) equipped with an integrated form generating function and an on-machine integrated measuring function. In addition, the novel machine tool engineering is established by analyzing the development processes of the AIMS.

【Research Methods】

The AIMS is newly constructed from the core technologies, which include structural design, manufacturing, assembly, and control engineering skills. These skills have been obtained from the advanced nano-pattern generator with a large work area “ANGEL”, as shown in Fig.1, and a 3D nano-measuring system “Nano-profiler” developed in our research group. Progress on the project is managed at each milestone and then the AIMS can be finally realized.

【Expected Research Achievements and Scientific Significance】

This project presents a newly developed mother machine equipped with innovative functions and originally designed structure. By systematizing the designing and manufacturing processes of AIMS, it is possible to establish the new machine tool engineering.

Expected research achievements are as follows:

- (1) Establishment of innovative nano-machining and nano-metrology technologies,
 - (2) Enhancement of global competitiveness of Japanese industry, and
 - (3) Development of nano-technology with wide area.
- Figure 2 shows typical research achievements

with scientific and industrial significances.

【Publications Relevant to the Project】

- Shinno,H., Yoshioka,H., Sawano,H., A newly developed long range positioning table system with a sub-nanometer resolution, CIRP Annals-Manuf.Tech., 6-1, pp.403-406, (2011).
- Yoshioka,H., Shinno,H., Design concept and structural configuration of advanced nano-pattern generator with large work area ”ANGEL”, Inter. Jour. of Automation Tech., 5-1, pp.33-44, (2011).

【Term of Project】 FY2012-2016

【Budget Allocation】 142,400 Thousand Yen

【Homepage Address and Other Contact Information】

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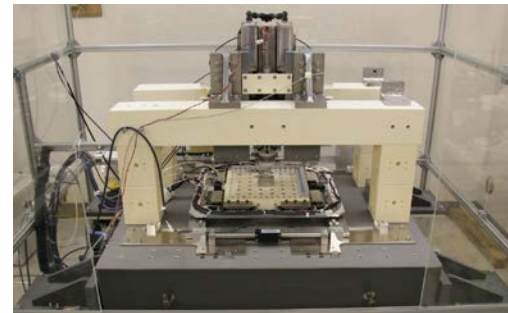


Figure 1 ANGEL

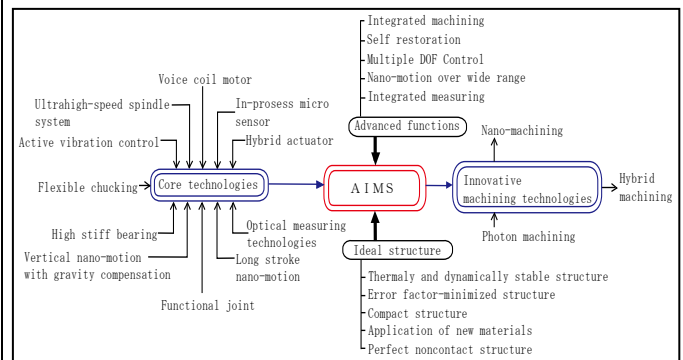


Figure 2 Research achievements