Advanced Production, Processing and Machining Method

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1. Course Description

Main topics are as follows:
・Typical advanced precision cutting methods (lathe and milling for nano-micro scale fabrications.)
・Numerical modeling and simulation of the cutting process
・Principle of the abrasive process and its advanced application
・Machine tools for ultra precision machining and their elements
・Measurement system for ultra precision machining
・Recent topics about the precision machining
etc.
*It is required that students have knowledge about typical material properties and fundamentals of the mechanics of materials, before lesson starts.

2. Course Objectives

An introduction of the principle of the advanced precision cutting and abrasive processes. Topics include machine tools and their elements measurement systems, environmental issues and recent progresses of this field.

3. Grading Policy

Discussions about some topics with teacher in few (or more) classes(total, 40%). Its issues will be announced before the classroom.
And the presentation about the assigned issues in last class(60%). The issue for the presentation will be announced before the final classroom.

4. Textbook and Reference

Textbook
Based on the original videos and electric files for the classroom.
Their will be introduced in the class.
Reference
Other references will be introduced in the class.

5. Requirements(Assignments)

English information will be announced on LMS (*internal use).
And the detail will be introduced in the class.

6. Note

This course will be taught in Japanese.

7. Schedule

[1]   Definition and classification of the precision machining processes
[2]   Machine tool for ultra precision machining #1: its principle and characteristics
[3]   Machine tool for ultra precision machining #2: practical and advanced applications
[4]   Cutting tools #1: its fundamentals and classifications
[5]   Cutting tools #2: advanced applications and problems
[6]   Metal cutting #1: its cutting characteristics (chip flow, cutting force, surface finish, and temperature) and nano-micro scale cutting and problems
[7]   Metal cutting #12: its numerical modeling and simulations by typical manners.
[8]   Ultra precision cutting (UPC) #1: difference from the conventional cutting, optimal setting of cutting conditions
[9]   Ultra precision cutting (UPC) #2: wear of the cutting edge in UPC, evaluation of the surface finish
[10]   Abrasive process #1: Grinding, its fundamental and practical applications
[11]   Abrasive process #2: Polishing, its fundamental and practical applications for ultra smooth surface finishing and problems
[12]   Energy beam process: ultra precision machining by photonic, electric, and ionic beams, their principle and applications
[13]   Measurement systems for precision machining: mechanical, optical and electrical approaches, their principle and applications
[14]   Intelligent manufacturing: contemporary systems and factories by artificial intelligence. The topics includes the deep learning and its practical applications on the manufacturing systems
[15]   Summarize and presentation