

Precision Machine System Design (M2794.01)

Spring Semester 2019, Mechanical and Aerospace Engineering,

Seoul National University

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Lecture Schedule: Mon/Wed 17:00-18:15 at 301-204

Abstract:

Precision machine system is the key platform for achieving ultra-precision performance in such as Precision Machine Tools, Semiconductor, Flat Panel Display, MEMS, Nano-Bio processing, and Robots. The design capability of precision machine system is one of the highly expected or 'MUST HAVE' skills for advanced mechanical engineers. This course is to provide fundamental principles and practical techniques for design of precision machine system. Several core concepts and design skills achieving high precision performance are introduced, and main themes are delivered such as error assessment, error-budgeting, design strategy, stiffness design, kinematic design, elastic design, thermal design, design of flexure-hinge mechanism, design for vibration/acoustic isolation. Precision actuators, dynamic matching, sensors and control schemes are also delivered.

Very intensive tutorial is also scheduled for skills in using S/W tools (Solidworks V.2017) for design, numerical simulation based on the finite elements method (FEM). Major design projects are assigned for innovative precision machine system design as the group projects, and the presentation of design is scheduled for competition.

Contents

- [1 Week] Fundamental concepts in precision machine design
- [2 Week] Accuracy assessment, and error budget for precision machine
- [3 week] Design Strategies and Principles
- [4 week] Stiffness design for machine structure
- [5 week] Kinematic design for machine elements
- [6 week] Elastic design, preloading, measurement/force loop, metrology frame
- [7 week] Design for thermal deformation and temperature control
- [8 week] Mid Exam and Term project assignment
- [9 week] Design of key-components for precision machine (slider, bearings)
- [10 Week] Design of flexure hinge mechanism
- [11 Week] Precision Actuators
- [12 Week] Power Transmission (Rotary and Linear)
- [13 Week] Dynamic Matching, Sensors and Control Schemes
- [14 week] Vibration/Acoustic Isolation
- [15 Week] Final Exam and Term project presentation

Tutorials: Design Software, and FEM software, with Solidworks (V.2017) environment

Lecture Note is provided via ETL.

Evaluation: Mid (25%), Final(25%), Reports and Projects(40%), Attendance(10%)