



Department of Mechanical Engineering
ME EN 7960 - Precision Machine Design

Syllabus

Instructor:	Prof. Eberhard Bamberg, 2124 MEB, bamberg@mech.utah.edu
Office hours:	Wednesday, 2:15 - 3:45 pm
Lectures:	Monday and Wednesday, 12:55-1:45 pm, MEB 1225
Course website:	http://www.mech.utah.edu/~me7960
Recommended text:	Class notes available for download from course website <i>Precision Machine Design</i> . Alexander H. Slocum, Society of Manufacturing Engineers, Dearborn, MI, 1995
Prerequisites:	ME EN 3910 or similar machine elements course, instructor's permission

Course Summary

The course provides an intensive coverage of precision engineering theory and its application to the design of complex production equipment such as machine tools, robots, and metrology devices.

Topics covered include: precision design philosophy; the current state of art; principles of accuracy, repeatability, and resolution; error budgeting; sensors and sensor mounting; contact and non-contact bearings for rotary and linear motion; actuators and transmissions; structural design; dynamic response and structural damping; solid modeling of complex systems.

The course aims to help students in developing creative designs and teaches techniques that allow the designs to be optimized through analytical and numerical methods. Weekly homework assignments provide ample opportunities to practice the concepts learned. The course culminates in a final project.

Final Project

The final project is designed as an exercise that allows the material learned in this class to be applied to a real world problem. The instructor will propose a limited number of projects to choose from. All projects will need to include the following:

- list of functional requirements
- error budget
- proof of design optimization (finite element analysis, analytical approaches, etc.)
- bill of materials
- complete solid model (assembly)
- engineering drawings

The project and some of the homework assignments require students to use a 3D solid modeling package which students are free to choose. This course does not teach any particular design or analysis software.

Grading

Assignments - 30%

Midterms - 30%

Final Project - 40%

TABLE 1 Course schedule Fall 2006

Week	Monday	Wednesday
Week 1 (08/21 - 08/25)		Course Introduction / Examples of PMDs
Week 2 (08/28 - 09/01)	Fundamentals of Errors	Fundamentals of Errors
Week 3 (09/04 - 09/08)	<i>Labor Day - no classes</i>	Linear Motion Systems
Week 4 (09/11 - 09/15)	Linear Motion Systems	Ball Screw Calculations
Week 5 (09/18 - 09/22)	Ball Screw Calculations	1. Midterm
Week 6 (09/25 - 09/29)	Alternative Linear Motion Systems	Alternative Linear Motion Systems
Week 7 (10/02 - 10/06)	Sensors and Encoders	Sensors and Encoders
Week 8 (10/09 - 10/13)	Contact Stresses and Deformations	Contact Stresses and Deformations
Week 9 (10/16 - 10/20)	Linear Rolling Element Bearing	Take Home Midterm
Week 10 (10/23 - 10/27)	<i>no class</i>	Rotary Rolling Element Bearings
Week 11 (10/30 - 11/03)	Non-Contact Bearings	Modeling Bearings
Week 12 (11/06 - 11/10)	Modeling Bearings	Flexures
Week 13 (11/13 - 11/17)	Design of Machine Structures	Design of Machine Structures
Week 14 (11/20 - 11/24)	Modal Analysis	Modal Analysis
Week 15 (11/27 - 12/01)	Project Discussions	Project Discussions
Week 16 (12/04 - 12/08)	Project Discussions	Final Projects due (5pm in MEB 2110)