

Mechanical Engineering 710 – Machine Tool Analysis

Winter - 2021

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Lectures: 3 hrs per week
Room: TBD

Objectives: To introduce some of the engineering aspects related to the analysis of machine tools and metal cutting processes. Requirements for machining will be discussed as well as various techniques for analyzing and modeling machine tool and process performance. Emphasis will be placed on practical issues related to modern manufacturing.

Grades: Project Proposal Abstract Draft due start of class 2nd lecture
Homework 40% (1–due 3rd Lect., 2–due 7th Lect., 3–due 10th Lect.)
Midterm break (no class) Feb 15-19
Course Project Presentation 10% Last day of classes
Final Exam (closed book) 30% Last day of course
Course Project Report 20% 2 weeks after classes end

Lecture Topic	Comments
1. Course Overview	Introduce our approach to machine tool analysis
2. Localized Cutting Process	Discussion of cutting process and forces
3. Friction and Wear	Tribology of machining
4. Machining Process	Detailed process discussion
5. Modeling	Modeling of machining processes
6. Machine Tool Vibration	Machine tool stiffness and vibration isolation
7. Process Dynamics	Modeling of end milling processes (stability lobes)
8. Machine Tool Accuracy	Discussion of issues and measurement methods
9. Interpolators	Discussion of different interpolation strategies
10. Machine Monitoring / Motion	Machine tool sensors, controls and actuators
11. Course summary	Summarize material and discuss final exam and project

Reference Books:

1. Yusuf Altintas, Manufacturing Automation 2nd Edition, Cambridge University Press, 2012.
2. Milton C. Shaw, Metal Cutting Principles, Clarendon Press, Oxford, 1997.
3. David A. Stephenson and John S. Agapiou, Metal Cutting Theory and Practice, Marcel Dekker, Inc., New York, 1997.
4. George Tlusty, Manufacturing Processes and Equipment, Prentice Hall, 2000.
5. Alexander H. Slocum, Precision Machine Design, Society of Manufacturing Engineers, 1992

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