

MFG 563 Metal Cutting Mechanics and Dynamics

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Course Description

Fundamentals of metal cutting mechanics, 2D and 3D cutting models; analysis of chip formation, friction; modelling and simulation of turning and milling processes, surface finish, and dimensional accuracy in machining; review of vibration theory and machine tool vibrations; introduction to modal analysis; chatter vibrations, dynamics and stability of cutting; chatter suppression techniques.

Outline	Week
- Overview of machining processes	1
- Orthogonal and oblique cutting	2-4
- Turning	5
- Milling and turning process modeling/simulation	6-7
- Review of mechanical vibration theory	8-9
- Chatter vibrations and orthogonal cutting process stability	10-11
- Stability of turning	12
- Stability of milling	13
- Chatter suppression methods	14

Labs (to be held in Manufacturing Research Lab.)

- Orthogonal cutting	3
- Oblique cutting	4
- Turning	5
- Milling	7
- Vibration measurements & modal analysis	9
- Turning stability tests	11
- Milling stability tests	13

Assignments: There will be several assignments which will include simulations in Matlab.

Lab Work: There will be regular lab sessions. The equipment and the procedure will be introduced, and data will be collected. You will be asked to do the relevant analysis on the data and provide a report.

Reading Assignments: You will also be asked to write abstracts for number of papers.

References

1. Altintas, Y. Manufacturing Automation, Cambridge University Press, 2000.
2. Tlusty, J. Manufacturing Processes and Equipment, Prentice Hall, 2000.
3. S. Kalpakjian and S.R. Schmid, Manufacturing Processes for Engineering Materials (Chapter 8), Prentice Hall, 2003.
4. Machining Dynamics: Fundamentals, Applications and Practices (Springer Series in Advanced Manufacturing), Edited by K. Cheng, Chapter 3: Control and Dynamics (E. Budak), ISBN-10/ASIN: 1846283671, Springer, 2008.

Grading

Assignments : 30 %

Lab work : 30 %

Final exam : 30 %

Reading Assignments : 10%