ME 623 Dynamics of Machining Processes (3-0-0-6)

Pre-Requisite: Metal cutting or machining (UG level, e.g. ME312)

Syllabus:

Mechanics of machining processes: Physics of orthogonal cutting and oblique cutting; Analytical, mechanistic modelling for cutting forces in turning, milling (straight and helical cutters), and drilling processes; Analytical and experimental methods for Identification of cutting force coefficients. Machining dynamics and chatter vibrations: Mathematical modeling of single and multiple degrees of free and forced vibrations; Frequency response functions; Analytical and experimental modal analysis of machines tool structures; Oriented frequency response function of machine tool structures; Identification of modal parameters; Introduction to chatter or self-excited vibrations; Types of chatter; Regenerative chatter mechanism; Mathematical models for regenerative chatter in orthogonal cutting operation. Stability Analysis: Stability analysis of single and multiple degrees of freedom models of orthogonal cutting operation; Stability modelling of turning process and milling operations using frequency and time domain approach; Introduction of stability model for drilling process. Chatter detection and suppression techniques: Prediction methods and experimental techniques for chatter avoidance; Passive and active suppression techniques.

Texts/References:

1. Yusuf Altintas, *Manufacturing Automation: metal cutting mechanics, machine tool vibrations, and CNC design*, 2nd Ed., Cambridge University Press, 2012
2. Tony L. Schmitz and Kevin, S. Smith, *Machining Dynamics: frequency response to improved productivity*, 1st Ed., Springer Science & Business Media, 2009
3. Kai Cheng, *Machining dynamics: fundamentals, applications and practices,* Springer Science & Business Media, 2008
4. George Tlusty, *Manufacturing Process and Equipment,*1st Ed., Pearson Education, 1999
5. Koenigsberger, Franz, and Jiri Tlusty. *Machine tool structures,* 1st Ed., Elsevier, 2016
6. Weihong Zhang and Min Wan, *Milling simulation: metal milling mechanics, dynamics and clamping principles,* Wiley-ISTE, 2016