



Short Courses in Model-based Problem Solving in Machining

Course 1

Machining Processes

Model-based Planning and Diagnostics

This course introduces the basics of how tool geometry affects power, forces, dimensional error and surface finish. The qualitative insight the models offer allow one to plan and diagnose problems with a better understanding of what is physically happening within the process.

Day 1	
1	Machining Process Modeling and Analysis
1.1	General Terminology
1.2	Motivation for Process Modeling
1.3	The Mechanistic Modeling Technique
1.4	Static vs. Dynamic Modeling
Break	
8:00 – 8:45	
2	Single Straight-Edged Cutting
2.1	Orthogonal Process Geometry
2.2	Force – Process-Geometry Relations
Break	
8:45 – 8:55	
2.3	Specific Energy and Force Prediction
2.4	Empirical Specific Energy Modeling
Lunch	
10:10 – 10:20	
2.5	The Oblique Cutting Process
3	
Nonstraight-Edged Cutting	
3.1	Modeling the Chip Geometry
3.2	Force Prediction
Break	
10:20 – 11:05	
3.3	Equivalent Lead Angle Modeling
3.4	Generic Profiles and Form Tools
Adjourn	
11:05 – 11:35	
Day 2	
4	
Multi-Tooth Processes	
4.1	The Boring Process
Break	
11:35 – 12:35	
4.2	The Face Milling Process
4.3	The End Milling Process
Break	
12:35 – 13:05	
4.4	The Drilling Process
5	
Introduction to High-Speed Machining Dynamics	
5.1	A Dynamic Model for Machining
Lunch	
13:05 – 13:35	
5.2	Vibration and Chatter
5.3	Stability Diagrams and Behaviors
Break	
13:35 – 13:50	
6	
Application Exercises	
6.1	Planning a Face Milling Cut — Cutter Path & Diameter; Number of Teeth
6.2	Diagnosing Cylinder Boring Error — Boring Inward vs. Outward
Break	
13:50 – 14:00	
7	
Chalk Talk — Discussion of Attendee-raised Issues	
7.1	Attendee Issue 1
7.2	Attendee Issue 2
Adjourn	
14:00 – 14:30	
15:30	