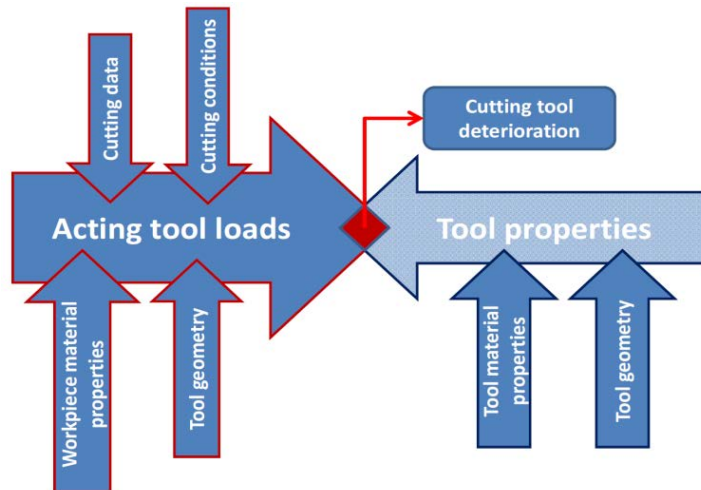


Course syllabus for

P22: Advanced Metal Cutting

Syllabus adopted 2020-08-20 by Professor Bengt-Göran Rosén, Produktion2030 Head of Education



Credits	7.5 hec
Grading scale	Satisfactory/not satisfactory
Education cycle	Third-cycle
Examiner	Prof. Jan-Eric Ståhl, Lund University
Eligibility	A Master's degree in production engineering or equivalent
Aim	Through better understanding of today's forefront of machining research the participants will be better suited to both implement and contribute to the continued development of the field of machining processes.
Intended learning outcomes	<p>After completion of the course the course participant should be able to</p> <ul style="list-style-type: none"> • describe the basic principles in metal cutting. • evaluate and describe the acting tool-loads with respect to mechanical, thermal and tribological effects. • understand and be able to do simple calculations that describe the interaction between tool stress conditions, tool geometry and the tool material properties.

- design cutting tests for specific purposes such as assessment of the tool lifetime, plastic deformation and fracture behaviour of cutting tools or assess workpiece materials machinability in one or more applications.
- analyse a cutting process and allocate development paths for cutting tool and work materials that allow for increased quality and reduced processing costs.
- have insight on the measurement principles for measuring static and dynamic cutting forces and tool movements.
- have insight on current research issues in the area of metal processing.

Course content

Analysis of production and production development of machining systems based on KPI numbers. Basic principles of metal cutting. Mechanical analysis and modelling, cutting resistance, load functions and variation numbers. Cutting force measurement and development of equipment for cutting force measurements. Thermal analysis and modelling. Stress analysis of cutting tools. Tribological analysis of surfaces in contact and contact relations in the cutting process. Archard's modified wear equation and Colding equation. Mechanics of chip generation and process dynamics and segment formation. Vibrations and instability as well as process damping. Micro geometries and its influence on cutting process with respect to vibrations and mode-locking. Tool properties for different application areas. Tool material and tool deterioration regarding cracking, chipping, breakage and deformation. New potential high-performance cutting materials are processed in connection with the future challenges in metal cutting are discussed. Micro- and macroeconomic models for evaluation and simulation of the cost outcomes.

Course organisation

Three physical meetings in Lund with 2-3 days per meeting.

First meeting:

- Fundamental introduction to industrial development and the connections between technology and economy. Focus on the machining process technical results that affect manufacturing economy and how these results are analyzed industrially.
- Overall material classification from a general perspective. Materials technology from a machining perspective, the influence of the material selection on the machinability and

the interaction with other method groups such as casting, forging and joining (welding).

- Introduction to metal cutting and basic definitions.
- Fundamental principles and definitions
- Mechanical analysis of the machining process

Second meeting:

- Mechanical analysis of the machining process
- Thermal analysis of the machining process
- Tribological analysis of the machining process
- Tool wear models and tool life models
- The chip forming process
- Workpiece materials and their machinability
- Continuation on workpiece materials and their machinability
- Tool materials and tool wear
- Economic considerations on the machining process and

Third meeting:

- Experiments and demonstrations practically demonstrating important parts of the course
- Continuation on previous day experiments followed by a brief summary and discussion on the obtained results

Examination

A successful completion of this course will be judged on the following:

- 4 assignments
- 3 laboratory works including written reports
- An individual written home exam at the end of the course
- The participants are compiled to attend 80 % or more of the scheduled time.

Literature

Metal cutting – Theories and models, 2012, Jan- Eric Ståhl in cooperation with Seco Tools, ISBN 978-91-637-1336-1