Gear production: 8 – 12 March 2010, Namur

Monday AM	Travel		
Monday PM	INTRODUCTION	Gear Basics	Dr. Türich (Gleason)
Monday PM	GEAR HOBBING	Gear Hobbing of small pitch applications - Technologies, Machines, Tools	Dr. Kobialka (Gleason)
Tuesday AM	GEAR SHAPING	Gear Shaping Chamfering & Deburring of gears Gear Shaving - Technologies, Machines, Tools	Dr. Kobialka Mr. Schäferling (Gleason)
Tuesday PM	GEAR HONING	Important Aspects of Premachining for Honing and Grinding Gear Honing Solution for modern Threaded Wheel Grinding Technology	Dr. Türich Mr. Schäferling (Gleason)
Wednesday AM	GEAR FINISHING	Decision Criteria for hard finishing processes Gear inspection Combined processes	Mr. Schäferling Mr. Deininger (Gleason)
Wednesday PM	GEAR FINISHING	Gear Hobbing of Large Module Gears Productivity Increase in Grinding of Large Module Gears	Dr. Kobialka Dr. Türich (Gleason)
Thursday AM	GEAR PRODUCTION	Other production technologies and discussion. Wrap-up and closing remarks	Tbd (Gleason)
Thursday PM	SURFACE TREATMENT	Gear (surface) hardening: methods, metallurgy, micro-structure, equipment, process, control: case hardening, nitriding, induction…	Guy Claus (Sirris)
Friday AM	SURFACE TREATMENT	In depth study of case hardening process: ovens, oil, harding profile (definition and measurement, standards), defects (overcarburising, oxydation…), process control, monitoring, optimal charge…	Guy Claus (Sirris)
Friday PM	Travel		

Gear Basics

1. Gear cutting principles
2. Gear cutting methods
2.1 Wildhaber-Novikov-Gear
2.2 Cycloid
2.3 Involute
3. Gear tooth and gear terms
3.1 Form of gears and flank directions
3.2 Terms and definitions
3.2 Helical gear
4. Mating gear terms
4.1 Meshing conditions
4.2 Addendum modification
5. Summary of gear formulas

Gear Hobbing

1. Basics of gear hobbing
1.1 process kinematic and characteristics
1.2 tools
1.3 cutting data and shift strategy
1.4 tool profiles
2. Gear hobbing and machine-integrated chamfering

2.1 chamfering and deburring principles
2.2 chamfering with a chamfering cutter (ChamferCut)
3. Finish hobbing
3.1 basics and aims
3.2 tool concepts
4. Skive hobbing

Gear shaping
1. Basics of gear shaping
1.1 Working principle
1.2 Rotary motion
1.3 Infeed motion and methods
1.4 Characteristics and applications
2. Gear shaping machine
2.1 Machine concept
2.2 Design of a gear shaper
2.3 Function principle of important components
3. Shaper cutter
3.1 Types
3.2 Specifications
3.3 Substrates and coatings
3.4 Wear behavior and sharpening process

Hard finishing processes
1. Basics of hard finishing
2. Skive hobbing
3. Gear honing
4. Gear grinding

Profile and generating grinding
1. Profile grinding
1.1 with electroplated CBN discs
1.2 with corundum discs
2. Generating grinding
2.1 with electroplated CBN worms
2.2 with corundum worms
2.3 LCS shifting strategies
2.4 Design of dressable grinding worms
2.5 Cutting conditions for dressable worms

Optimizing the gear grinding process
1. Influences on the grinding process
2. Quality corrections with the LCS
2.1 MoB and stock symmetry
2.2 Profile angle fh (dressable tools)
2.3 Profile optimization with a CBN disc

2.4 Optimizing the lead
3. Gear grinding simulation with SIM2
4. Error analysis
4.1 A possible way how to solve the problem
4.2 Examples

Handling of electroplated CBN tools
1. Basics of tool technique
1.1 Properties of abrasives
1.2 Architectural structure of electroplated CBN tools
1.3 Coating thickness of roughing and finishing worm
1.4 Manufacturing process
2. Wear behaviour of electroplated CBN tools
2.1 Types of wear
2.2 The tray-wear
3. Grinding technology
3.1 Influences on the gear grinding process
3.2 Stock distribution
3.3 Cutting parameters
3.4 Tool life

1. Hardening gear steel: general processes

- Metallurgical basics :
    - equilibrium state : FE-C diagram, metallographic structures
    - transient state : CCT- and TTT-diagram's and corresponding structures
- Quenching media and quenching intensity
- Relationships : massivity, steel characteristics & quenching intensity
- Predicting the hardening profile : use of CCT-diagram's and Jominy-curves
- Stress relieve : influence of composition, time & temperature on mechanical properties
- Relation between material properties and static-, dynamic- and chock resistance
- Choice of material in respect of harden ability

2. Carbonising process (and carbonitriding):

- Principles of gas carbonising, transmission and diffusion of C (and N)
- Structure and properties of the case and core
- Variants of carburizing and carbonitriding steel, criteria for selection
- Design and drawing specifications, parameters for quality control
- Impact of heat treat parameters on contact- and root strength
- heat treat distortion : influencing factors

3. The practice of carbonising and carbonitriding

- Principles of kinetics of process reaction, equilibrium, activity
- C-potential and carburising levels
- Production of carburizing atmosphere

- Control of carburizing atmosphere
- Diffusion process: built up of C-pofile, carburising depth (At)
- limits to carbide (overcarburising risk)
- Hardening depth (Eht), in relation to At, harden ability, massivity, quenching intensity
- Rest austenite and optimal C-content at the surface
- Unwanted side effects: surface oxidation, surface bainite, porosity
- Optimisation of the carbonising cycle: boost/diffusion techniques
- Process simulation