Research on Intelligent Machine Tools & Manufacturing Processes in Belgium

Prof. Dr. Ir. B. Lauwers, K.U.Leuven
bert.lauwers@mech.kuleuven.be
For those who do not know me…?

- Full Professor, K.U. Leuven
- Research & Education in Manufacturing Processes and Digital Manufacturing
- Research topics (of my group)
  - Multi-axis Machining, Electrical Discharge Machining, Hybrid Processes,…
  - Machining of advanced materials (ceramics,..) & complex shaped
  - Advanced tool path planning and generation (CAD/CAM, CAPP)
  - ….
Is Belgium active in the domain…?

• Large activities in countries like Germany, Italy, Switzerland, Spain,…
  – There are quite some machine tool manufactures

• What about Belgium
  – Are there activities?

• Yes, there are quite some R&D activities related to **Intelligent Machine Tools (elements)** and **Advanced Manufacturing Processes**
• **Mechatronics** is the basis for the development of intelligent machine tools!
• Important players in Belgium!

**R&D on the Intelligent Control of Machines and Systems (in a broad sense)**
Mechatronics & Intelligent Machine Tools

- Development of active (structural) elements
  - Piezo-driven structural elements
    - Adaption of machine tool structures
- High speed control of drives and actuators
- High speed spindles (air bearings)
- Monitoring (sensing) and adaptive control
  - Monitoring (and control of manufacturing processes)
    - E.g. Laser cutting, Selective Laser Sintering, EDM,…
- …and others…
Example: High Precision Machine Tool

- Precision Grinding
  - Materials
  - Measuring Frames
  - Machining accuracy within 300nm
The Autonomous Machine Tool

- The Intelligent (autonomous) Machine Tool within the Digital and Smart Factory
  - Robots in manufacturing
  - High Level programming

- Machine tools / production systems are intelligent, stand-alone and act like “printers”
  - Machine tool behaviour is known to the system (even outside the company) after plug-in
    - “Add Machine Tool”
R&D on Manufacturing Processes

• K.U.Leuven & Sirris are important players

• We follow the international vision
  – (1) Sustainable Manufacturing
  – (2) ICT-enables intelligent Manufacturing
  – (3) High-productivity Manufacturing
  – (4) Materials in Manufacturing
R&D on Manufacturing Processes

- Development and Machining of new materials in Manufacturing
  - Ceramics and composites
    - Various Ceramic Materials (WC-ZrO₂, Borides,..)
    - Plastics
    - Ti-alloys
  - Advanced Process Technologies
    - Additive Manufacturing (SLM, 3D-printing,..)
    - Vibration Assisted Machining
    - Electrical Machining (EDM, ECM,..)
    - Deep drawing and pressing
    - ....
R&D on Manufacturing Processes

- **High precision and complex shaped** manufacturing
  - Multi-tasking & Multi-axis machine tools
  - Micro Manufacturing
    - Micro EDM, micro Milling, Micro RPT,..
R&D on Manufacturing Processes

- **Sheet Metal** Manufacturing
  - Laser cutting
  - Incremental Forming

Through monitoring and feedback
R&D on Manufacturing Processes

- Research (K.U.Leuven) & Advise/Support (Sirris) in the area of **Dimensional Metrology**

X-ray CT tomograph for dimensional measurement (450kV)

Metrology lab with 3D CMMs, etc.

Optical 3D measurement
There is much more in Belgium

Large critical mass to be internationally competitive

Many institutes active in the area of machine tool building and manufacturing processes!

K.U. Leuven University
+ 4 clusters of university colleges
There is expertise, even in..

- Belgium is (was) known for a large number of small **family breweries**!

- Small breweries group together to be **internationally known** and competitive!!
Even R&D in beer making

- K.U.Leuven Association introduces a new beer
  - Result of a co-operation between several research labs (K.U.Leuven Association) and small companies !!!

[Image of a beer bottle, lab equipment, and a scientist]

Succesvolle samenwerking

Het samenvloeien van de universitaire kennis en de knowhow van de hogescholen K.U.Leuven als een open en dynamisch netwerk van hogeronderwijsinstellingen

‘Definitely the best beer in the World’

Surplus is het resultaat van een interessante samenwerking tussen de KAHO domeinen:

www.surplus-bier.be
As a conclusion….

- Belgium is perhaps small, but active in the area of **intelligent machine tool building** (in a broad sense) and **manufacturing technologies**
- **Large number of institutes** where grouping/clustering is going on to have the critical mass to be competitive within an international context

*Thank you and enjoy your evening*