Automated grinding robot programming

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Me @ voestalpine BÖHLER Aerospace

Aleksandar Stanojevic

- 2012-2016: PhD student MUL AMB
- 2016-2018: R&D Project manager
- Since 2018: Head of Innovation Management
- Since 2022: Innovation management consultation

Main research areas:

- Material characterization & modelling
- Process simulation & automation
- Digitalization & data science

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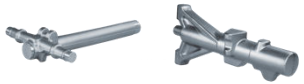
Manufacturing high performance parts

AEROSPACE

Wing Components/Pylon Parts

Engine Mounts



Landing Gear Components

Horizontal Stabilizer

Structural Parts Fuselage

Structural Parts Wing Box

Engine Discs

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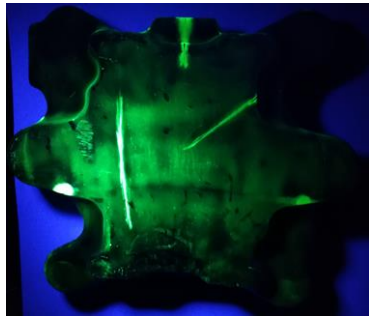
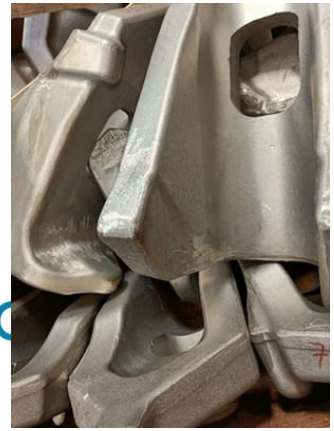
Background

Typical aerospace forgings

Typical surface defects





Motivation

- In aerospace industry:
  - High number of complex forging geometries with low quantity
- Robot-based process automation limited by high robot programming effort, due to:
  - Manual path planning
  - Manual collision monitoring
  - Tricky integration of parts in robot coordinate system
- Clamping of parts make expansive fixtures necessary

Yaskawa Type-MH 225 on a TSL 2000 lane

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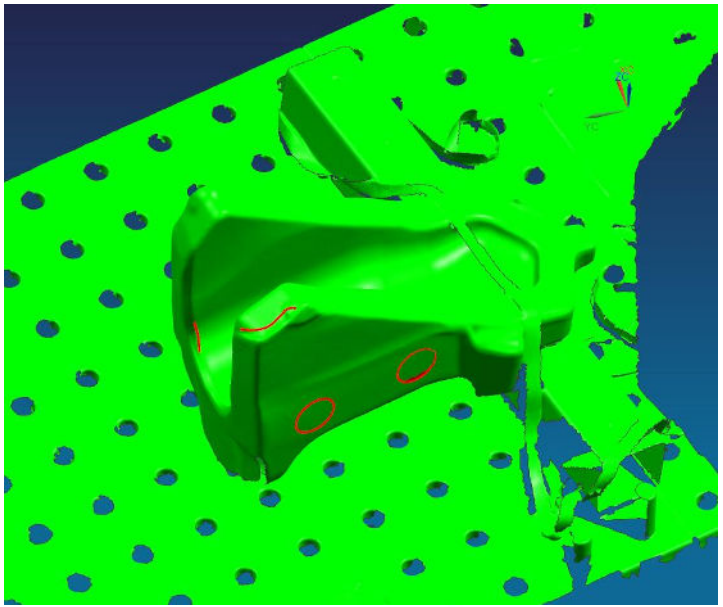
Challenge

- Develop a concept to minimize manual effort for process setup (1-klick operation)

- Input:
  1. Scan of actual parts and fixtures (.stl-file)
  2. Coordinates of regions (.iges-files), that have to be grinded
  3. Virtual representation of all important parts (cell, coordinate origin, robot position, parts)
  4. Process limitations

Part with defect positions



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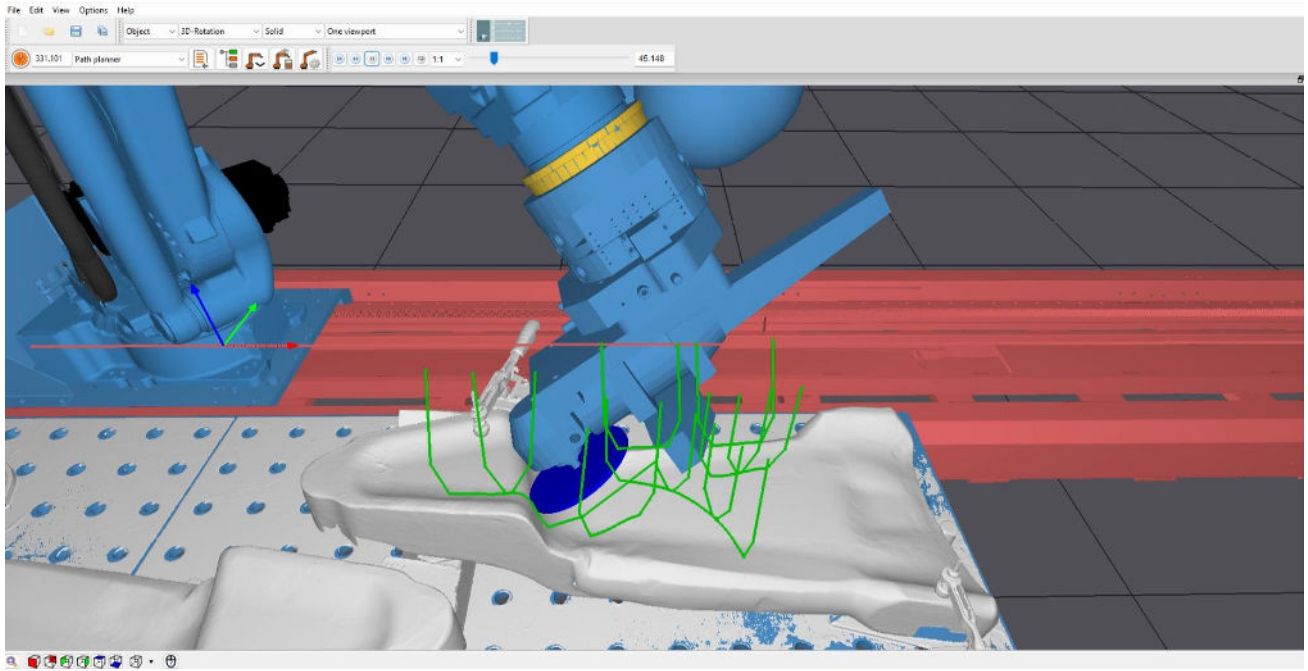
Robot path programming with CIT AUTOMAPPPS

- Acceleration of robot path programming by **x20**



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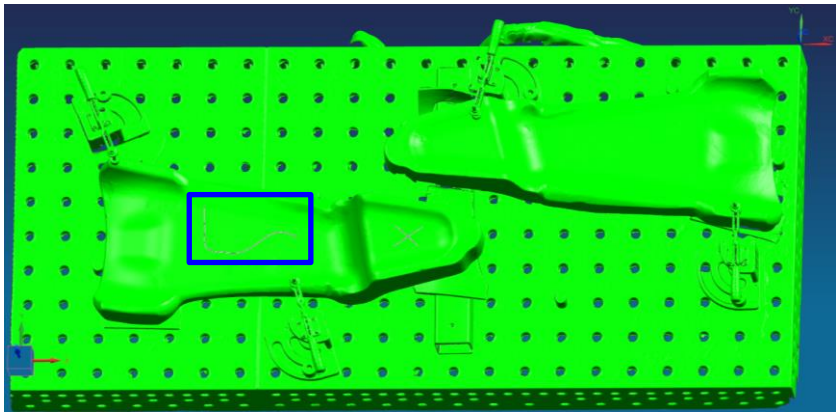
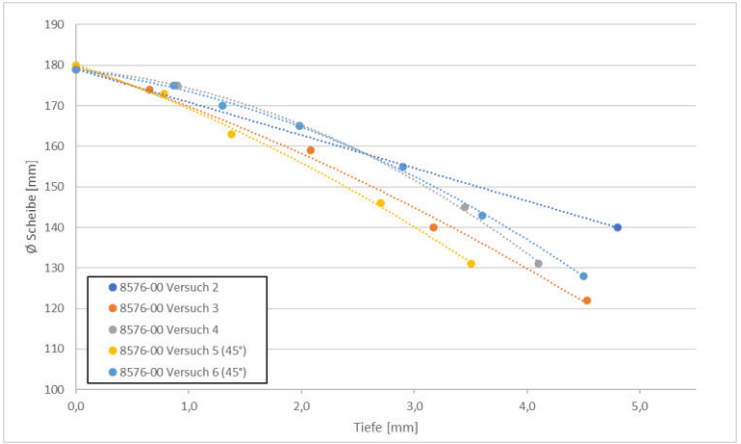
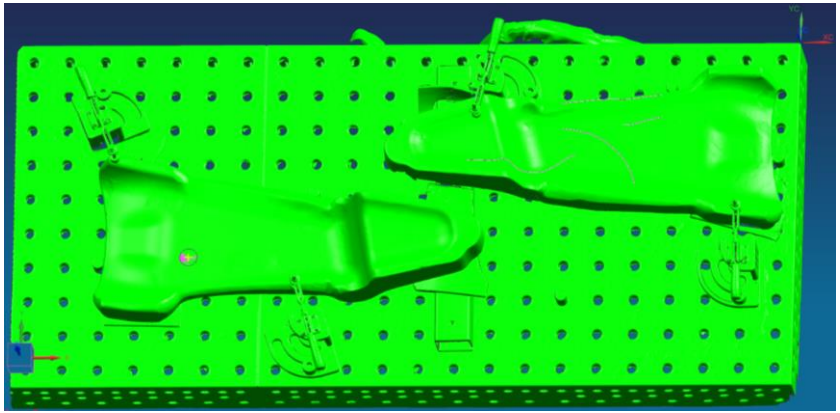
Grinding trial: complex path

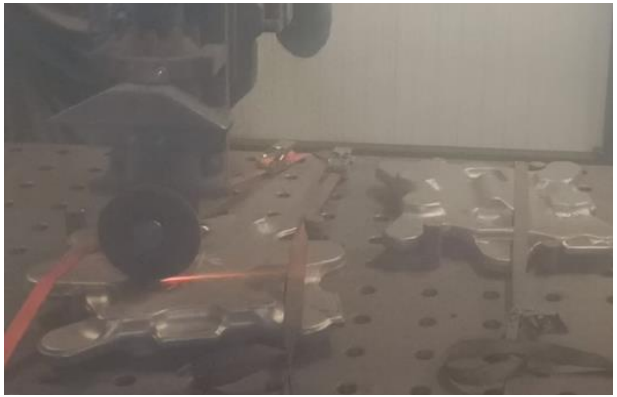




- Challenges:
  - Collision with surroundings
  - Keeping continuous contact between tool and part
  - Robot accuracy

Grinding trial: tooling points





» Useful for simple paths and planes with large grinding area

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Thank you

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