ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

Óbuda University
Doctoral School of Material Sciences and Technology

Optimization of ball end milling tool path in case of free form milling

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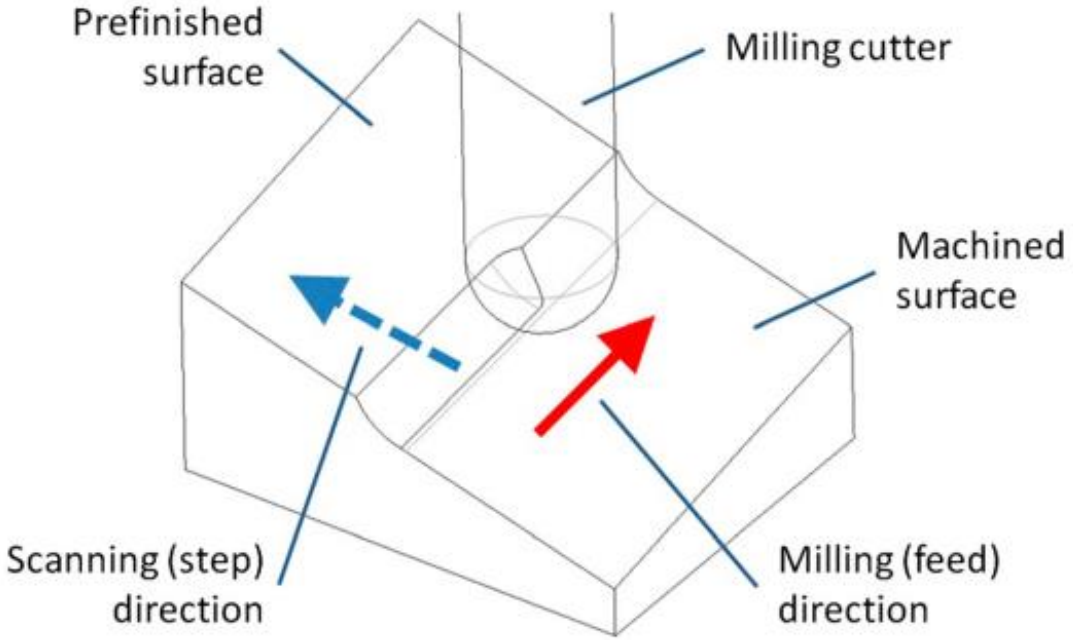
Main Topics

Freeform surfaces are defined as surfaces those have one or more nonplanner, nonquadratic surfaces that represented by parametric and/or tessellated models.

Ball end mills : Using Ball end mill has become widely in manufacturing specially in Highspeed machining process. The unique shape of the cutting edge (Helix-type, S-type, etc) gives this tool a vital role in machining sculpture surfaces or what it is called free form surfaces.

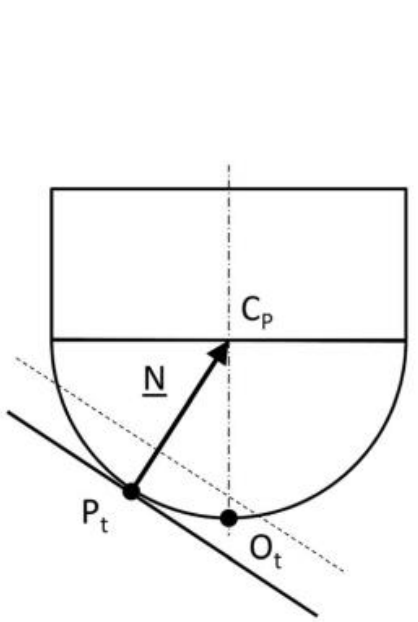
The aim of this research

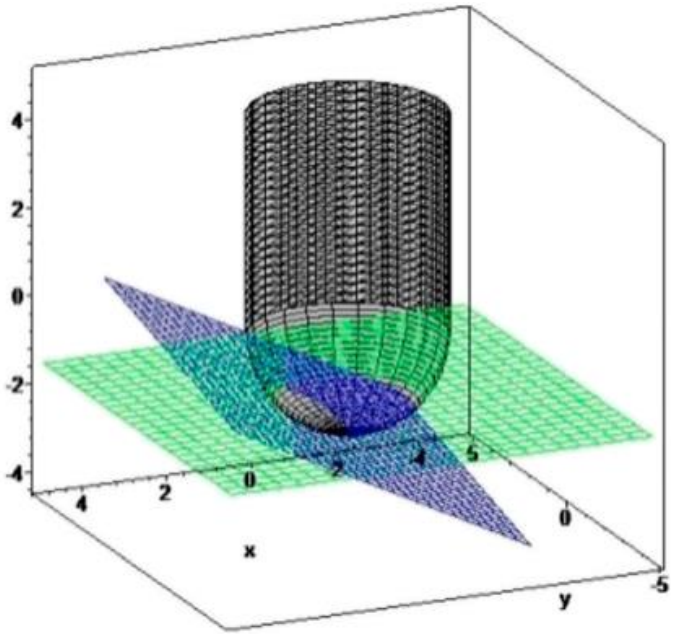
- The aim of this research is to find a new tool path planning strategy for freeform surfaces using ball end tool,
- which considers the changing of the working diameter and/or cutting speed.

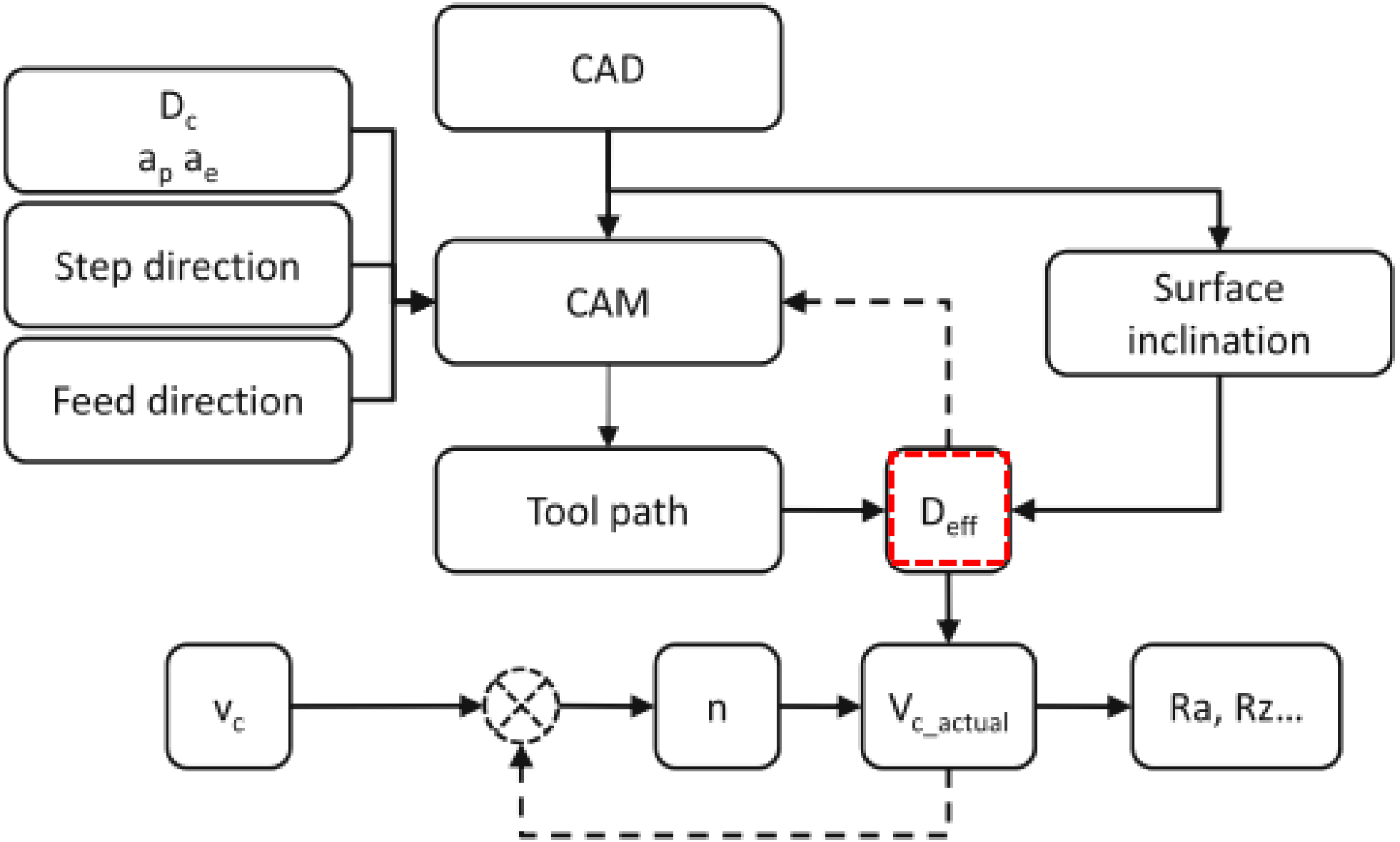


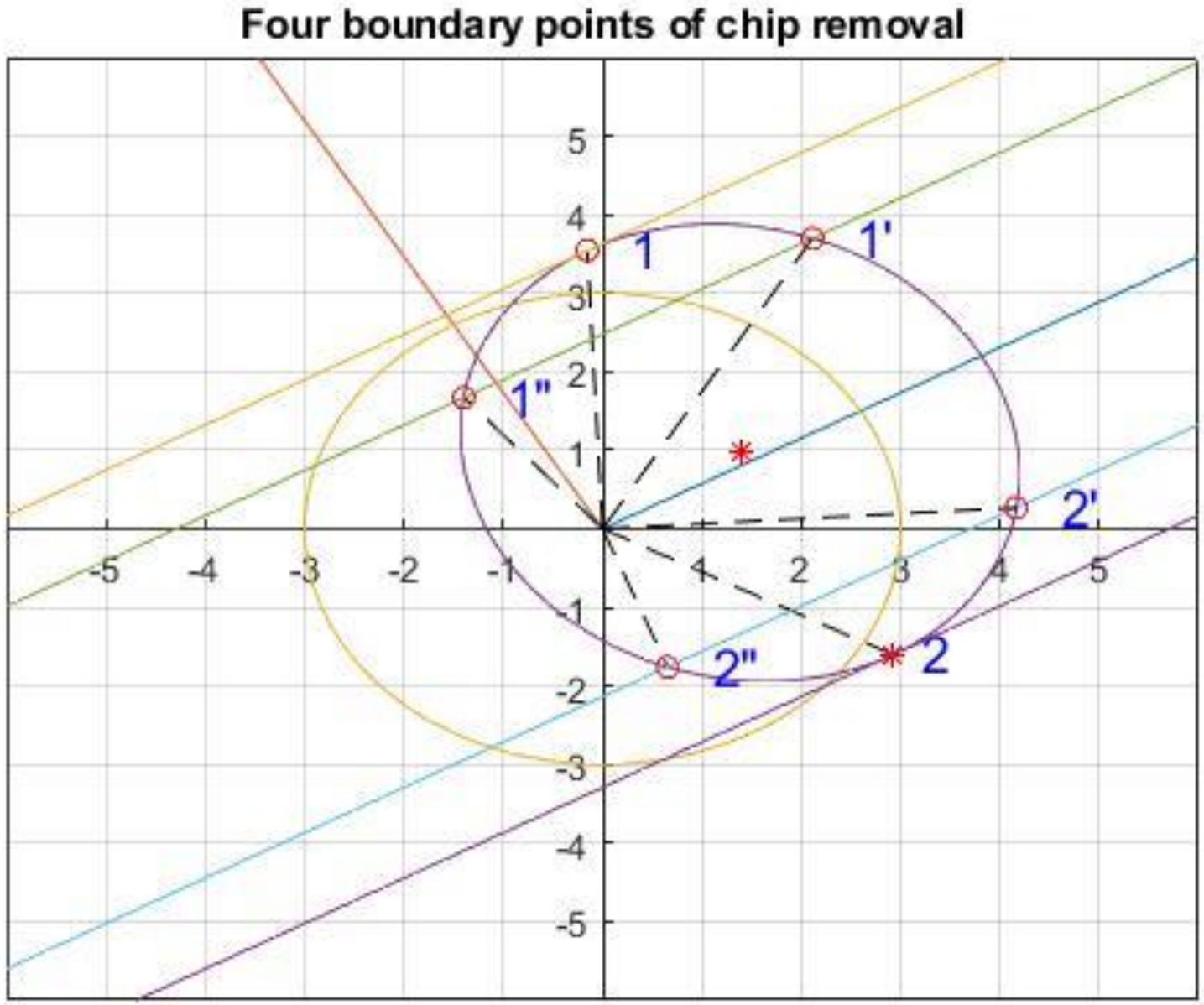
Results of the previous semester

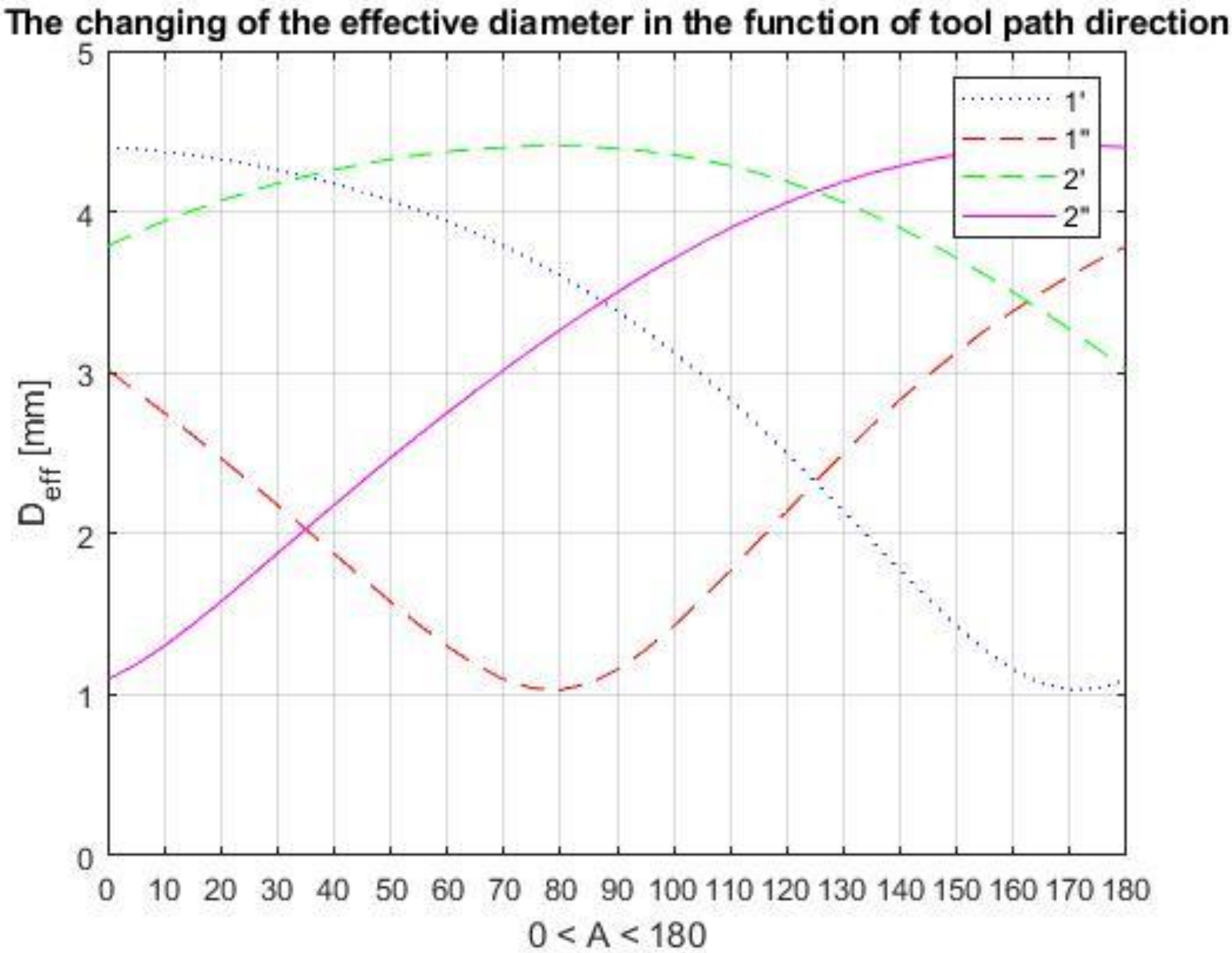
- Implementation calculation of working diameter in Matlab



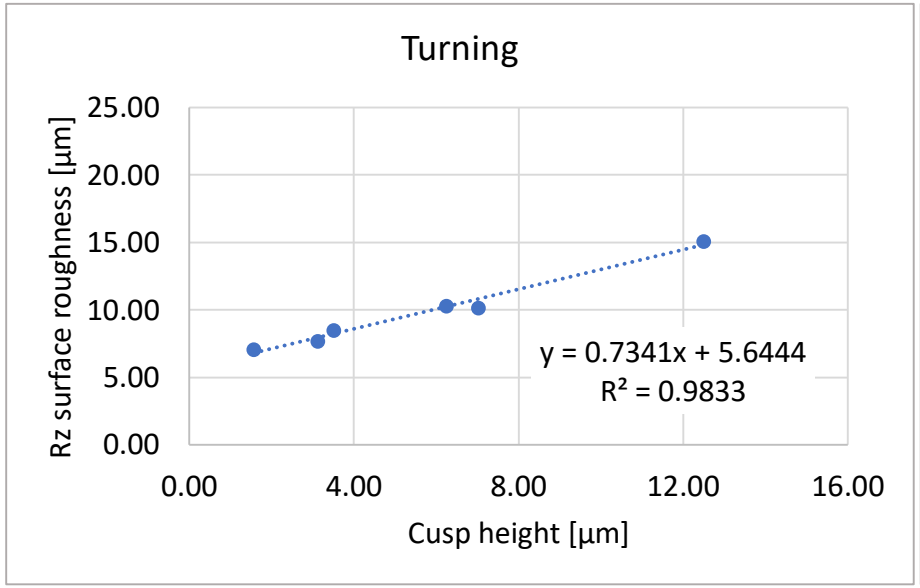


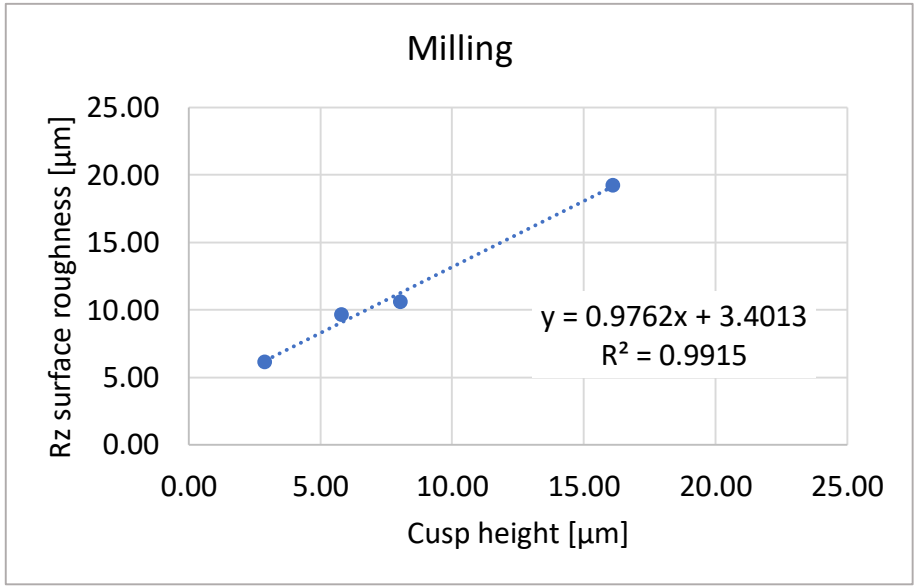

CAD
D_c
a_p a_e
Step direction
Feed direction
CAM
Surface inclination
Tool path
D_{eff}
v_c
n
V_{c_actual}
Ra, Rz...

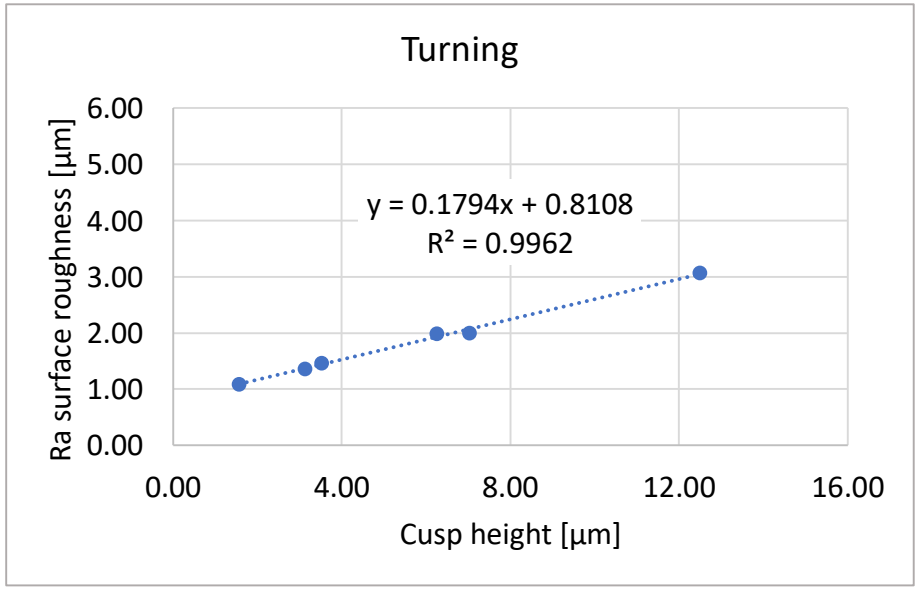

Four boundary points of chip removal
1
1'
1"
2'
2"
2
5
4
3
2
1
-1
-2
-3
-4
-5
-5
-4
-3
-2
-1
1
2
3
4
5

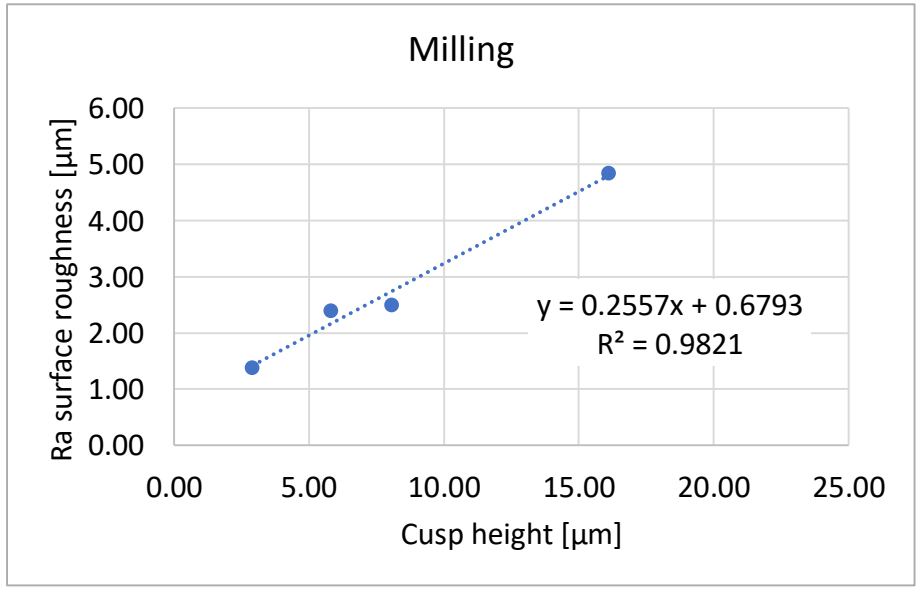

The changing of the effective diameter in the function of tool path direction
D_eff [mm]
0 < A < 180
1'
1"
2'
2"
0
1
2
3
4
5
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

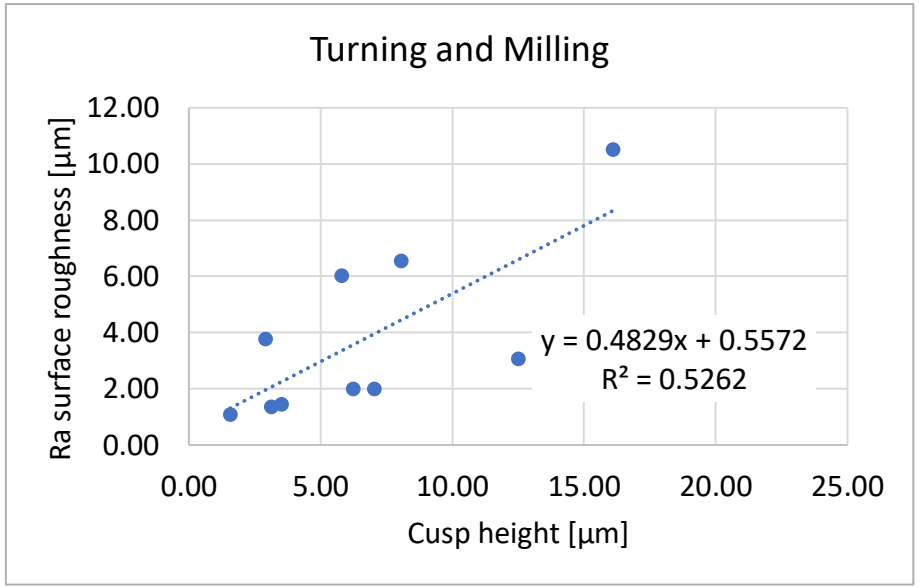
Milling vs Turning

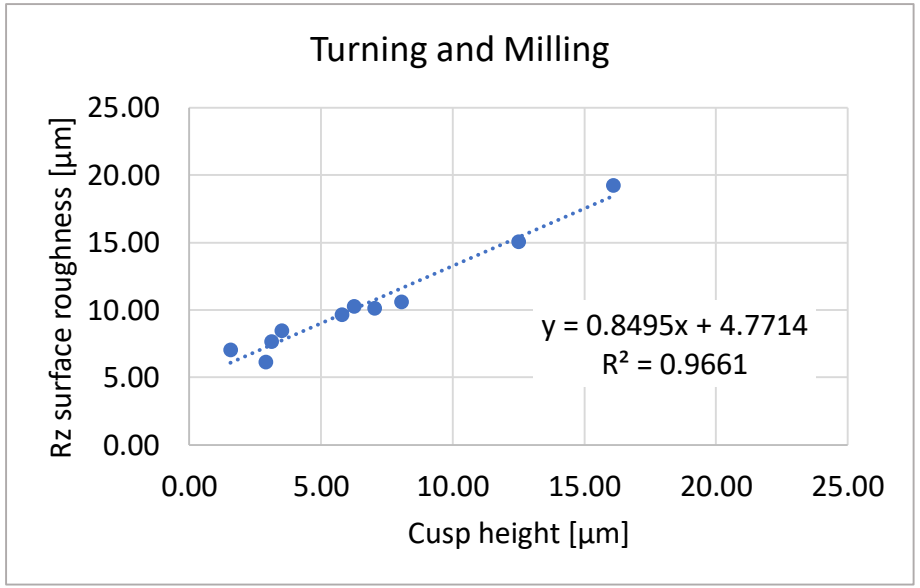


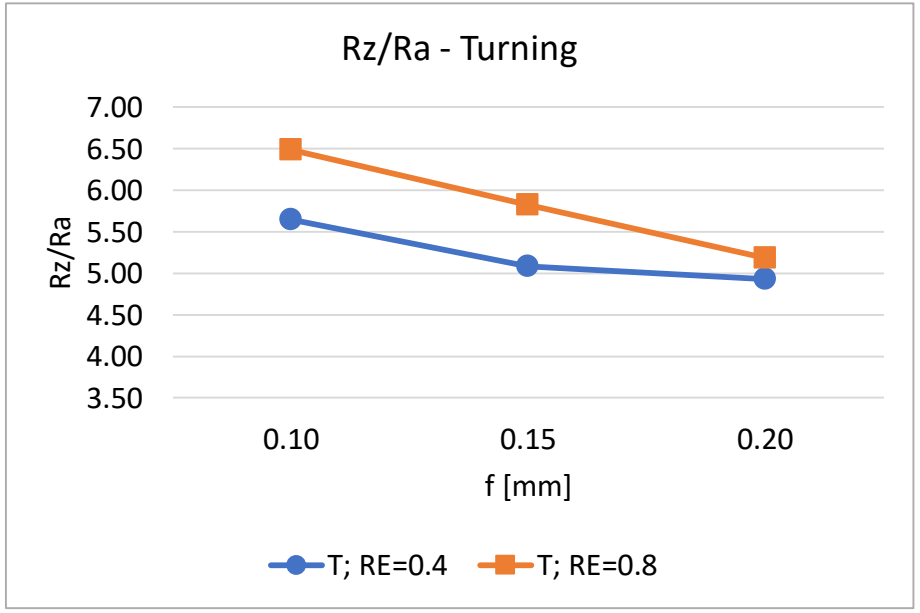


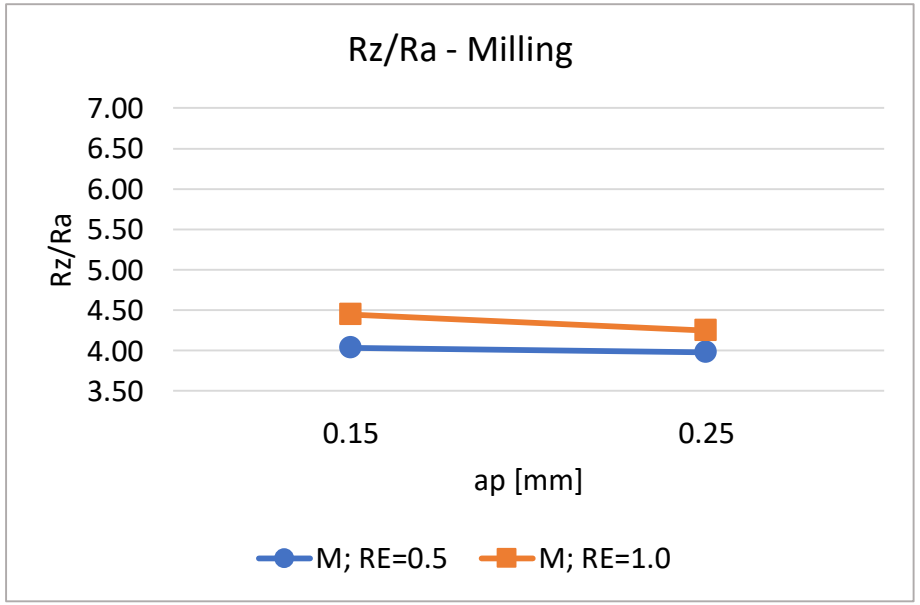





Turning and Milling
Ra surface roughness [µm]
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
5.00
10.00
15.00
20.00
25.00
Cusp height [µm]
y = 0.4829x + 0.5572
R² = 0.5262

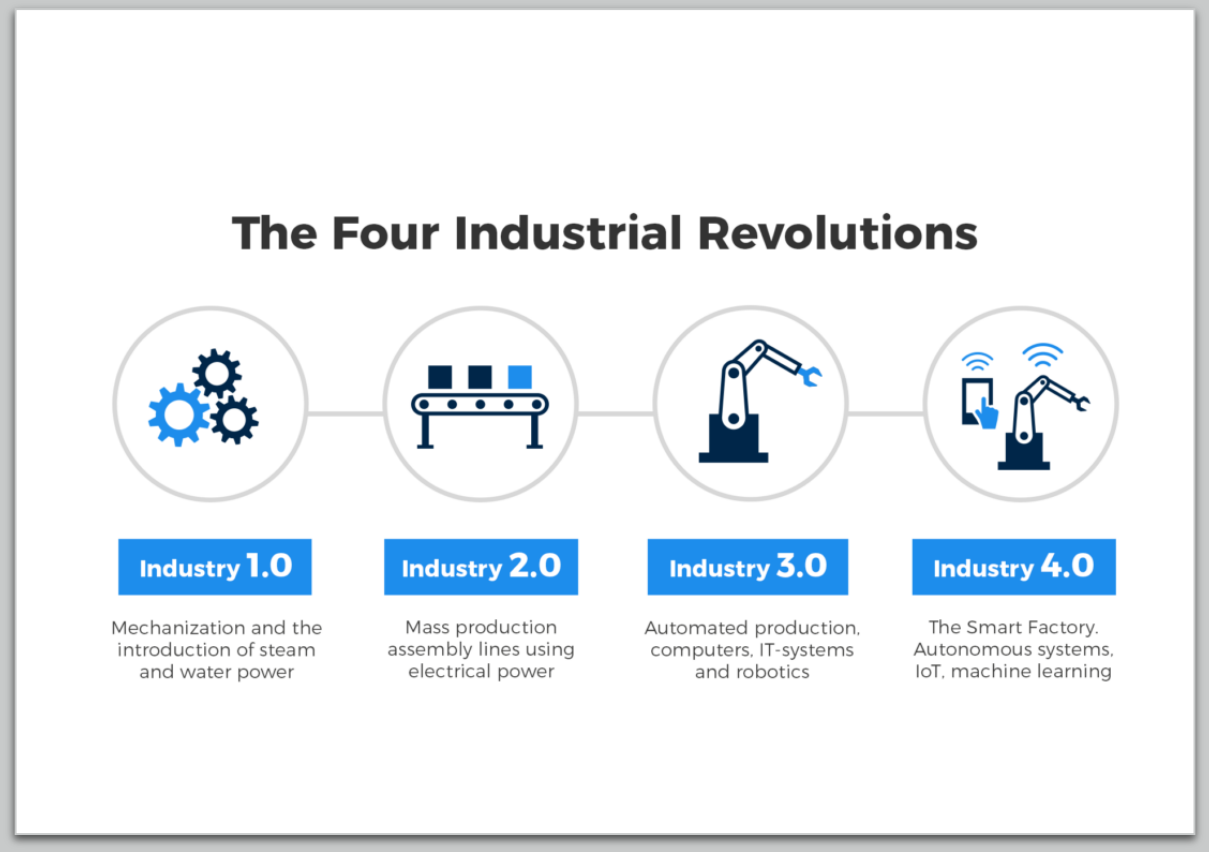

Turning and Milling
Rz surface roughness [µm]
25.00
20.00
15.00
10.00
5.00
0.00
0.00
5.00
10.00
15.00
20.00
25.00
Cusp height [µm]
y = 0.8495x + 4.7714
R² = 0.9661


Rz/Ra - Turning
Rz/Ra
7.00
6.50
6.00
5.50
5.00
4.50
4.00
3.50
0.10
0.15
0.20
f [mm]
T; RE=0.4
T; RE=0.8


Rz/Ra - Milling
Rz/Ra
7.00
6.50
6.00
5.50
5.00
4.50
4.00
3.50
0.15
0.25
ap [mm]
M; RE=0.5
M; RE=1.0

Courses completed

- Industry 4.0
- Engineering education

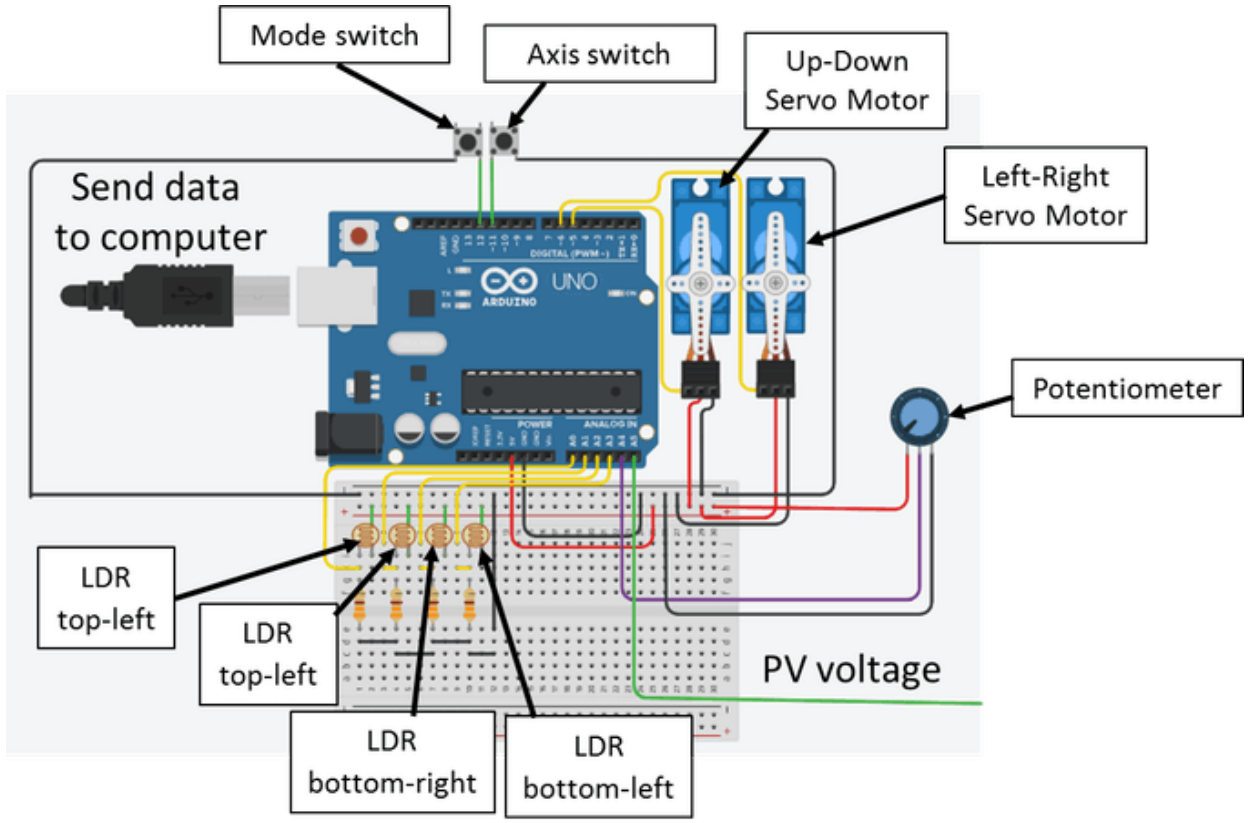


Publication

- Published:
  - Design of Experiment in Investigations Regarding Milling Machinery
- Ready to be published:
  - Comparison of surface roughness when turning and milling

Educational activity

- I am the supervisor for thesis work for a masters' student
  - Thesis title: Sun tracker solar system.



Future Work

- Analyse the tool-path planning strategies on the quality of the surface roughness in order to develop an optimal mathematical model. Besides, study the CAM systems and CAD interface.

Thank you for your attention