Master's thesis industrial engineering sciences

Study and create a post-processor for CAD/CAM software for 5 axes CNC milling

Bart Nullens

Academic year: 2013-2014

Problem defenition and goal

The problem with 5 axes milling is the complexity, the ability to use contour milling, compared to 3 axes milling because of the added degrees of freedom. Another problem is that a post processor is unique for every machine. The goal of this thesis is to develop a post processor for a specific 5 axes milling machine, the Mikron UCP 600.

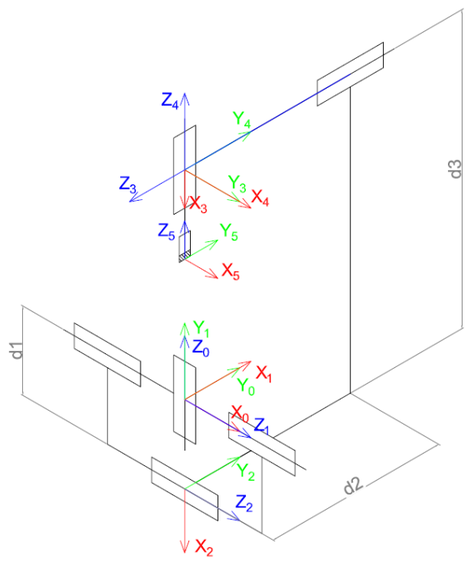
Mikron UCP 600

- 5 axes (X, Y, Z, A, C)
- Heidenhain iTNC530 controller

Cimatron E11

- CAD/CAM solution
- NC toolpath creation
- Build in post-processor, editor and compiler (GPP)

Kinematic solution

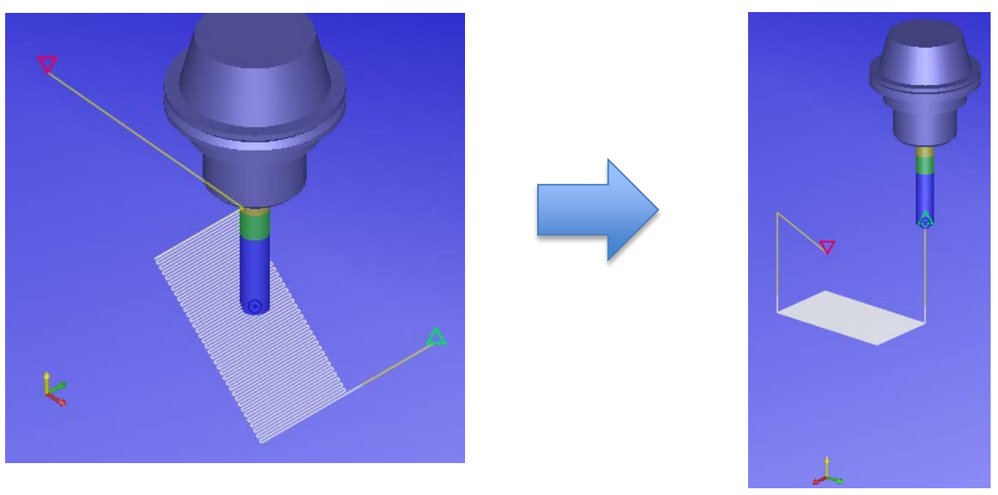


Denavit-Hartenberg method to convert coordinates between frames. This results in a machine specific transformation matrix.

Transformation matrix

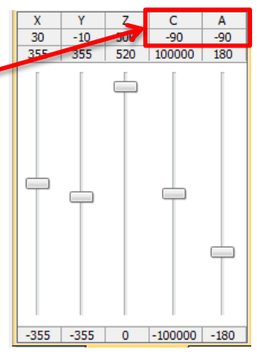
$$ROTMAT = \begin{bmatrix} \cos(C) & -\sin C & 0 \\ \sin(C) * \cos(A) & \cos(C) * \cos(A) & -\sin(A) \\ \sin(C) * \sin(A) & \cos(C) * \sin(A) & \cos(A) \end{bmatrix}$$

The rotation matrix is implemented in GPP. The toolpath is now transformed so the UCS is aligned with the machine UCS.

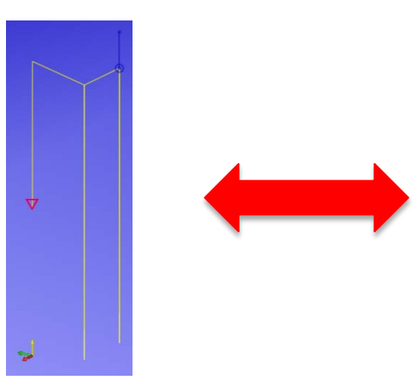


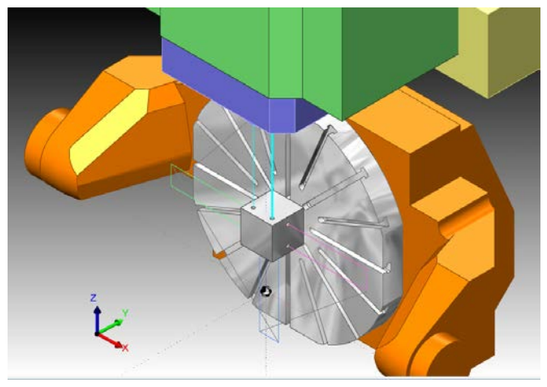
G-code analysis

```
1  %
2  O0100
3  T02
4  G90 G80 G00 G17 G40
5  G43 H02 Z150. S1000 M03
6  G00 C-90.0 A-90.0
7  Z320.
8  G98 G81 X30. Y-60. Z40. R71. F350 M08
9  X-30.
10 G80 Z320.
```



On the left the resulting G-code is shown with below its toolpath. On the right the CAM simulation with the machine values are shown. From this analysis we can conlcude that the transformation matrices are correct and the G-code is excecuted in the correct order.





Conclusion

- Unique post-processor specific for Mikron UCP 600
- The complexity is not solved, contour is milling not possible. Only position milling is possible.

Promoters: Ing. John Bijnens
Prof. Dr. Hoang Vinh Sinh

Hanoi University of Science and Technology

KU LEUVEN | universiteit hasselt