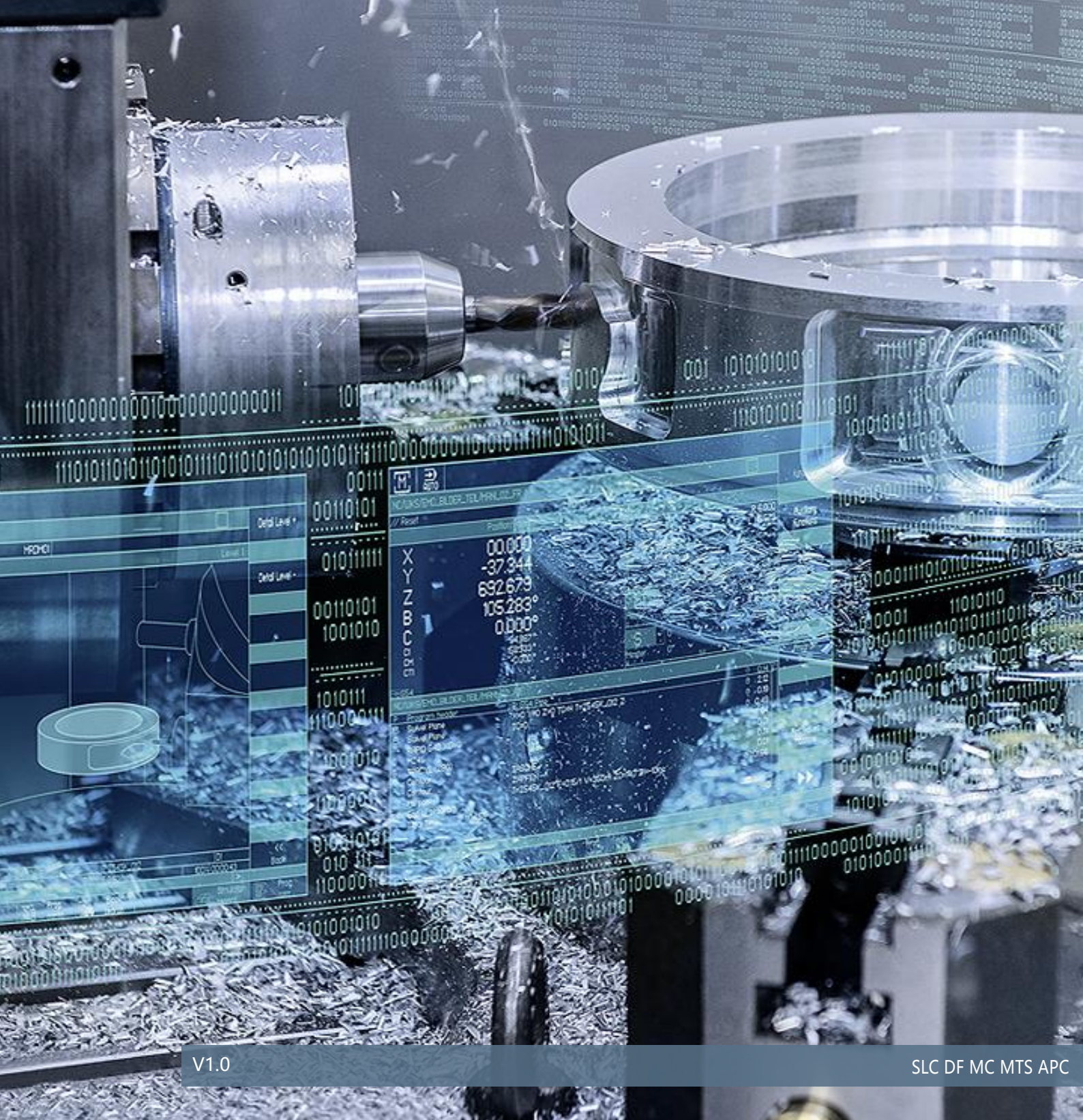




V1.0

SLC DF MC MTS APC

异步子程序控制刀具法向退刀

SINUMERIK840D sl

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异步子程序控制刀具法向退刀

➤ 任务

CYLE800 或 TRAORI 刀具摆动后，使用快速输入信号触发异步子程序（SETINT(1) PRIO=1 LIFTFAST），异常情况下控制刀具沿法向退刀。异常情况包含误操作，断电个等。

➤ 测试结果

- 无论是 Swiveling 或 TRAORI 和 TOFRAME 改变刀具方向，均可使用 SETINT(1) PRIO=1 LIFTFAST 控制刀具法向退刀
- 使用 SETINT(1) PRIO=1 LIFTFAST控制刀具法向退刀，不受倍率开关控制
- 使用 SETINT(1) PRIO=1 LIFTFAST控制刀具法向退刀时，所有轴使能必须ON

1 测试条件

1.1 版本信息

Version data	
SINUMERIK 840D sl – 840DSL-72	
Name	Actual version
CNC software	U04.07 + SP 03 + HF 01
Basic PLC program	04.07.11
System extensions	
OEM applications	
User	
Hardware	

1.2 轴配置

Machine configuration						
Machine axis		Drive		Motor		
Index	Name	Type	No.	Identifier	Type	Channel
1	MX1	Linear				CHAN1
2	MY1	Linear				CHAN1
3	MZ1	Linear				CHAN1
4	MA1	Rotary				CHAN1
5	MC1	Rotary				CHAN1
6	MSP1	Spindle				CHAN1

1.3 选项

M36

Synchronized actions stage 2
6FC5800-0AM36-0YB0



M42, M43

High-speed retraction from the contour
6FC5800-0AM42-0YB0



Multiple mode actions
6FC5800-0AM43-0YB0



2 机床设置 – Type 24

2.1 通用数据

```
N10000 $MN_AXCONF_MACHAX_NAME_TAB[0]    "MX1"
N10000 $MN_AXCONF_MACHAX_NAME_TAB[1]    "MY1"
N10000 $MN_AXCONF_MACHAX_NAME_TAB[2]    "MZ1"
N10000 $MN_AXCONF_MACHAX_NAME_TAB[3]    "MA1"
N10000 $MN_AXCONF_MACHAX_NAME_TAB[4]    "MC1"
N10000 $MN_AXCONF_MACHAX_NAME_TAB[5]    "MSP1"
```

2.2 通道数据

```
N20050 $MC_AXCONF_GEOAX_ASSIGN_TAB[0]=1
N20050 $MC_AXCONF_GEOAX_ASSIGN_TAB[1]=2
N20050 $MC_AXCONF_GEOAX_ASSIGN_TAB[2]=3

N20060 $MC_AXCONF_GEOAX_NAME_TAB[0]="X"
N20060 $MC_AXCONF_GEOAX_NAME_TAB[1]="Y"
N20060 $MC_AXCONF_GEOAX_NAME_TAB[2]="Z"

N20070 $MC_AXCONF_MACHAX_USED[0]=1
N20070 $MC_AXCONF_MACHAX_USED[1]=2
N20070 $MC_AXCONF_MACHAX_USED[2]=3
N20070 $MC_AXCONF_MACHAX_USED[3]=4
N20070 $MC_AXCONF_MACHAX_USED[4]=5
N20070 $MC_AXCONF_MACHAX_USED[5]=6

N20080 $MC_AXCONF_CHANAX_NAME_TAB[0]="XX"
N20080 $MC_AXCONF_CHANAX_NAME_TAB[1]="YY"
N20080 $MC_AXCONF_CHANAX_NAME_TAB[2]="ZZ"
N20080 $MC_AXCONF_CHANAX_NAME_TAB[3]="A"
N20080 $MC_AXCONF_CHANAX_NAME_TAB[4]="C"
N20080 $MC_AXCONF_CHANAX_NAME_TAB[5]="SP1"
```

2.3 五轴设置 – TYPE 24

```
N24400 $MC_TRAFO_TYPE_4=24 ; Generic transformation Tool
type
```

```
N24410 $MC_TRAFO_AXES_IN_4[0]=1 ; M_X1 linear axis in
N24410 $MC_TRAFO_AXES_IN_4[1]=2 ; M_Y1 linear axis in
N24410 $MC_TRAFO_AXES_IN_4[2]=3 ; M_Z1 linear axis in
```

```

N24410 $MC_TRAFO_AXES_IN_4[3]=5      ; M_C1 1ST rotary axis
N24410 $MC_TRAFO_AXES_IN_4[4]=4      ; M_A1 2ND rotary axis
tool orientation

N24420 $MC_TRAFO_GEOAX_ASSIGN_TAB_4[0]=1 ; axis name X after
turn on TRAORI
N24420 $MC_TRAFO_GEOAX_ASSIGN_TAB_4[1]=2 ; axis name Y after
turn on TRAORI
N24420 $MC_TRAFO_GEOAX_ASSIGN_TAB_4[2]=3 ; axis name Z after
turn on TRAORI

N24426 $MC_TRAFO_INCLUDES_TOOL_4=1

N24620 $MC_TRAFO5_ROT_SIGN_IS_PLUS_2[0]=1
N24620 $MC_TRAFO5_ROT_SIGN_IS_PLUS_2[1]=1
N24620 $MC_TRAFO5_ROT_SIGN_IS_PLUS_2[2]=1

N24630 $MC_TRAFO5_NON_POLE_LIMIT_2=2
N24640 $MC_TRAFO5_POLE_LIMIT_2=2

; I3 - Base_Tool_X
N24650 $MC_TRAFO5_BASE_TOOL_2[0]=0
N24650 $MC_TRAFO5_BASE_TOOL_2[1]=0
N24650 $MC_TRAFO5_BASE_TOOL_2[2]=100

; I2 - Joint_offset_X
N24660 $MC_TRAFO5_JOINT_OFFSET_2[0]=0
N24660 $MC_TRAFO5_JOINT_OFFSET_2[1]=0
N24660 $MC_TRAFO5_JOINT_OFFSET_2[2]=0

; I1 - Part_Offset =-(Base_Tool_X+Joint_offset_X)
N24600 $MC_TRAFO5_PART_OFFSET_2[0]=0
N24600 $MC_TRAFO5_PART_OFFSET_2[1]=0
N24600 $MC_TRAFO5_PART_OFFSET_2[2]=-100

N24664 $MC_TRAFO5_NUTATOR_AX_ANGLE_2=45
N24666 $MC_TRAFO5_NUTATOR_VIRT_ORIAX_2=0

N24670 $MC_TRAFO5_AXIS1_2[0]=0
N24670 $MC_TRAFO5_AXIS1_2[1]=0
N24670 $MC_TRAFO5_AXIS1_2[2]=1

N24672 $MC_TRAFO5_AXIS2_2[0]=1
N24672 $MC_TRAFO5_AXIS2_2[1]=0
N24672 $MC_TRAFO5_AXIS2_2[2]=0

N24673 $MC_TRAFO5_AXIS3_2[0]=0
N24673 $MC_TRAFO5_AXIS3_2[1]=0
N24673 $MC_TRAFO5_AXIS3_2[2]=0

```

N24674 \$MC_TRAFO5_BASE_ORIENT_2[0]=0
 N24674 \$MC_TRAFO5_BASE_ORIENT_2[1]=0
 N24674 \$MC_TRAFO5_BASE_ORIENT_2[2]=1

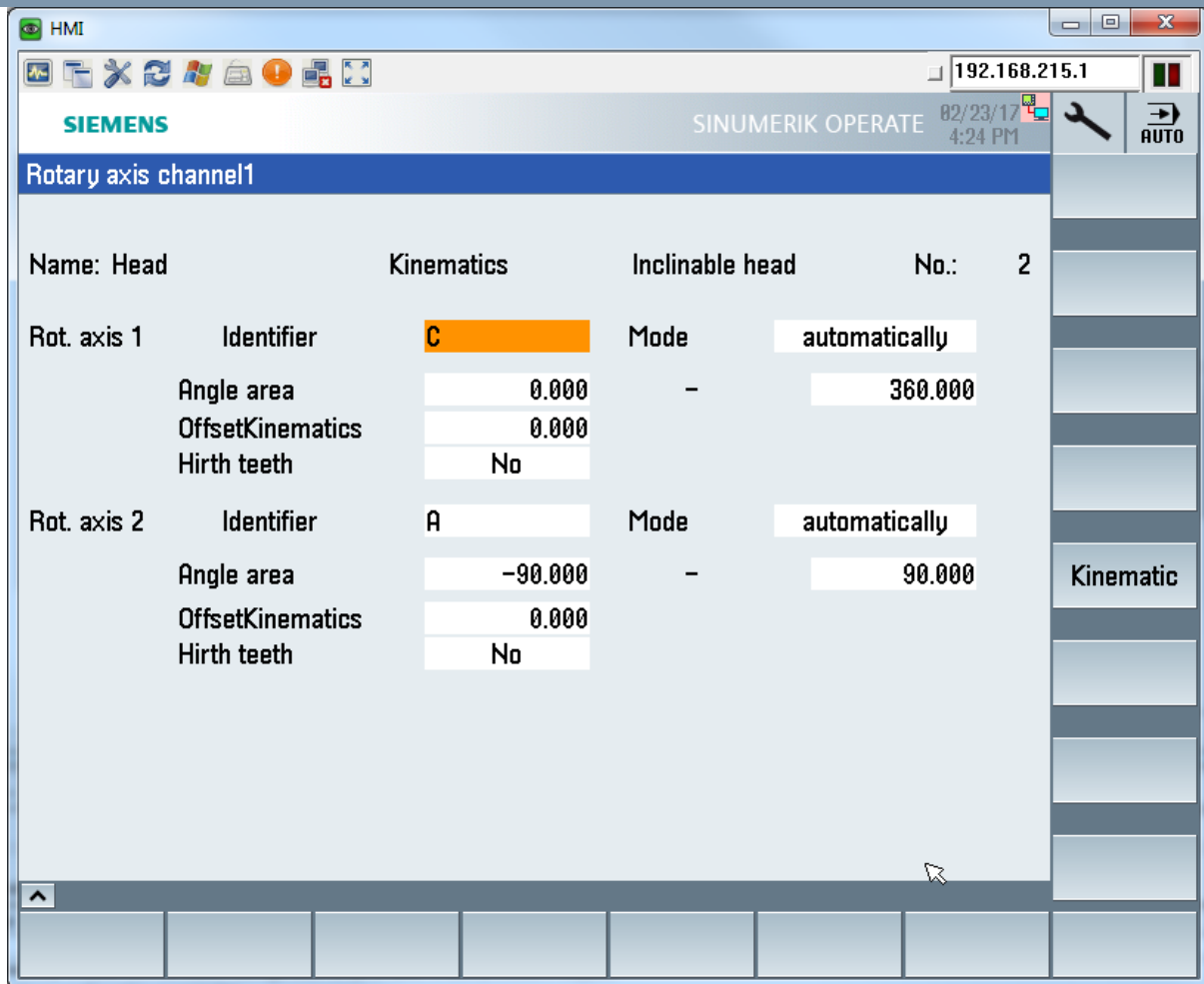
N24680 \$MC_TRAFO5_TOOL_VECTOR_2=2
 N24682 \$MC_TRAFO5_TCARR_NO_2=2

2.4 摆动设置 – TYPE 24

Kinematic channel1

Name	Head	Kinematic	Inclinable head	No.	2
Enable	Yes				
Retract	Z				
Retract position		X	Y	Z	0.000 [mm]
Offset vector I1		0.000000	0.000000	-100.000000	[mm]
Rotary axis vector U1		0.000000	0.000000	1.000000	
Offset vector I2		0.000000	0.000000	0.000000	[mm]
Rotary axis vector U2		1.000000	0.000000	0.000000	
Offset vector I3		0.000000	0.000000	100.000000	[mm]
Swivel mode	Axis by axis				
Rotary axes direct	Yes	Track tool	No		
Projection angle	No				
Solid angle	No				
Direction refer.	Rotary axis 1, - direction selected				
JobShop functions	Automatic swivel data record change				
	Automatic tool change				

Buttons on the right: Swivel +, Swivel -, RotAxis, Save data record, Delete data rec., Back



3 参数设置

➤ 说明

中断优先级低的中断程序可被具有更高优先级的中断程序中中断。

```
N10350 $MN_FASTIO_DIG_NUM_INPUTS =5
```

```
N11602 $MN_ASUP_START_MASK='H7'
```

```
11602:$MN_ASUP_START_MASK = FH
```

- ☒ Bit 0: ASUB self-starting
- ☒ Bit 1: Reserved
- ☒ Bit 2: Start also permissible with read-in disabled
- ☒ Bit 3: JOG in ASUB possible

```
N11604 $MN_ASUP_START_PRIO_LEVEL=2
```

```
N21210 $MC_SETINT_ASSIGN_FASTIN='H1'
```

定义快速输入字节，如选择 NC 快速 IO 的第 2 个字节作为中断字节

```
21210:$MC_SETINT_ASSIGN_FASTIN = 2H
```

- ☐ Bit 0: Number of input byte
- ☒ Bit 1: Number of input byte
- ☐ Bit 2: Number of input byte
- ☐ Bit 3: Number of input byte
- ☐ Bit 4: Number of input byte
- ☐ Bit 5: Number of input byte
- ☐ Bit 6: Number of input byte

➤ 例如

```
SETINT(1) PRIO=1 LIFTFAST
```

；当 NC 快速输入的第二字节的位 1 有信号，即 \$A_IN[9]=1 时，系统会触发中断。
使用接口信号制作假的 NC 快速输入

```
A I7.7  
=DB10.DBX123.0
```

4 LIFTFAST 语句

➤ 说明 LIFTFAST 从轮廓快速回退功能

- 机床轴的 MD32000 必须一致，否则触发从轮廓快速回退功能，系统报警 1016
- 回退速度是 MD32000 的 90%
- 回退速度不受倍率控制，如通道进给倍率 DB21.DBB4，快速倍率 DB21.DBB5 或轴倍率 DB3x.DBB0
- 回退触发后，回退动作不能使用复位信号终止，如方式组复位 DB11.DBX0.7，通道复位 DB21.DBX7.7
- 回退触发后，回退动作不能使用机床轴硬件限位信号终止，如 DB31.DBX12.1，DB31.DBX12.2；正常的程序指令如 G0/G1，触发硬件限位信号后，自动终止程序运行
- 回退触发后，回退动作只能通过急停复位信号或切断轴使能信号终止
- POLFMASK(), POLF[] 编程可使用 几何轴名，通道轴名，或机床轴，如

```
POLFMASK(Z) POLF[Z]=10  
POLFMASK(Z) POLF[ZZ]=10  
POLFMASK(AX3) POLF[AX3]=10
```


以上编程，在本次测试中，结果相同！

从轮廓快速回退，即刀具与工件快速脱离，回退的方向由下面指令指定。

第 46 组 G 代码中有: LFTXT, LFWP, LFPOS。

LFPOS: 指定回退的位置，由 POLFMASK 和 POLF 指定轴的绝对位置

5 使用 CYCLE800 刀具摆动后，控制刀具法向退刀

```
N10 TRAFOOF  
N20 CYCLE800(0,"0",100000,30,0,0,0,90,0,0,0,0,0,-1,100,1)
```


N30 M0
N40 SUPA G0 X0 Y0 Z0 C0 A0
N50 M0
N60 LFPOS ;由POLFMASK 和POLF指定轴的回退的位置,
N70 POLF[Z]=10
N80 POLFMASK(Z)
N90 SETINT(1) PRIO=1 LIFTFAST
N100 M0
N110 CYCLE800(0,"Head",100000,39,0,0,0,0,90,0,0,0,0,-1,100,1)
N120 M0
N130 G1 Z10 F1000
N140 M0
N150 M30

5.1 刀具摆动(C=0 A=90)后，刀具法向回退功能测试

5.1.1 刀具参数

Tool list											
Loc.	Type	Tool name	ST	D	Length	Ø		N			
		CUTTER_LIFT	1	1	50.000	10.000		0			

5.2 程序执行到 N120 处 M0 停止，刀具摆动 C=0 A=90

几何轴 X=0, Y=150, Z=-150

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NC/WKS/LIFT/LIFT_01_2

interrupted

MRD ⚠ Stop: M0/M1 active

Work	Position [mm]	Dist-to-go	T,F,S	Head
X	0.000	0.000	T CUTTER_LIFT	Ø 0.000
Y	150.000	0.000	D1	L 50.000
Z	-150.000	0.000	F RAP TRAV	mm/min 100%
A	90.000 °	0.000	S1 0	
C	0.000 °	0.000	Master 0	0.0%

G54

X

NC/WKS/LIFT/LIFT_01_2

N110 CYCLE800(0,"Head",100000,39,0,0,0,0,90,0,0,0,0,-1,100,1)¶

N120 M0¶

N130 G1 Z10 F1000¶

N140 M0¶

N150 M30¶

¶

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

G functions

Auxiliary functions

Basic blocks

Time / counter

Program levels

Act. values Machine

机床轴 MX1=0, MY1 =0, MZ1=50, MA1=90, MC1=0

SIEMENS

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02/23/17 4:56 PM

M

AUTO

NC/WKS/LIFT/LIFT_01_2

interrupted

MRD ⚠ Stop: M0/M1 active

Machine	Position [mm]	Dist-to-go	T,F,S	Head
MX1	0.000	0.000	T CUTTER_LIFT	∅ 0.000
MY1	0.000	0.000	D1	L 50.000
MZ1	50.000	0.000	F RAP TRAV	mm/min 100%
MA1	90.000 °	0.000	S1 0	☒
MC1	0.000 °	0.000	Master 0	0.0%

G54

X

NC/WKS/LIFT/LIFT_01_2

N110 CYCLE800(0, "Head", 100000, 39, 0, 0, 0, 0, 90, 0, 0, 0, -1, 100, 1)¶

N120 M0¶

N130 G1 Z10 F1000¶

N140 M0¶

N150 M30¶

¶

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

G functions

Auxiliary functions

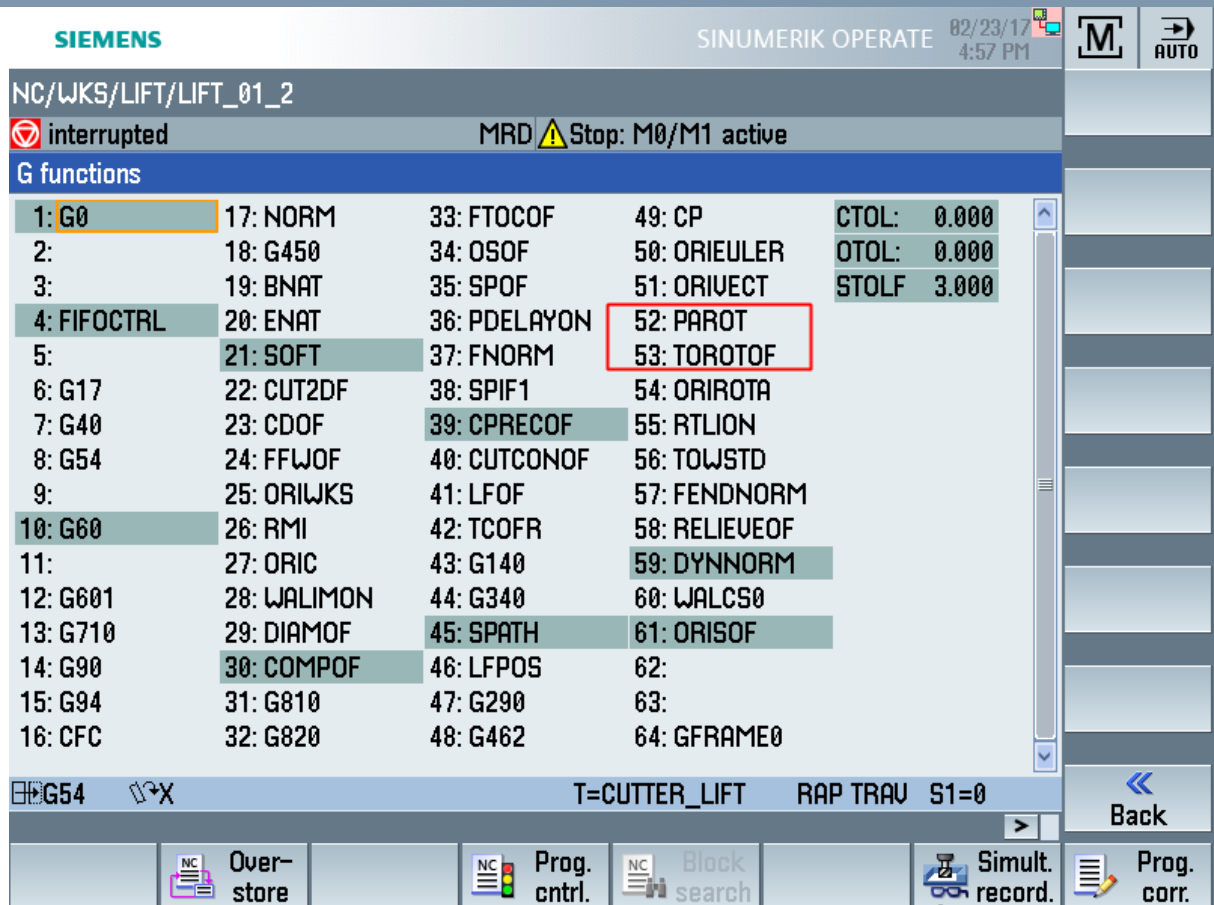
Basic blocks

Time / counter

Program levels

Act. values Machine

有效的 G 功能,



5.3 测试 1：程序控制刀具法向退刀

- AUTO 方式执行 N130 控制几何轴 Z 移动到 Z10

N130 G1 Z10 F1000

5.3.1 执行 N130 G1 Z10 F1000

- 说明 刀具旋转 C=0, A=90; 编程 N130 G1 Z10 F1000 控制几何轴 Z, 实际上是机床轴 MY1 移动

5.3.1.1 N130 执行前

几何轴 X 余程=0, Y 余程=0, Z 余程=160

NC/WKS/LIFT/LIFT_01_2

active

MRD ⚠ Wait: Axis enable missing YY

Work	Position [mm]	Dist-to-go	T,F,S	Head
X	0.000	0.000	T CUTTER_LIFT	∅ 0.000
Y	150.000	0.000	D1	L 50.000
+Z	-150.000	160.000	F 0.000	
A	90.000 °	0.000	1000.000 mm/min 120%	
C	0.000 °	0.000	S1 0	

G54 X

NC/WKS/LIFT/LIFT_01_2

N120 M0

N130 G1 Z10 F1000

N140 M0

N150 M30

G functions

1: G1	13: G710
2:	14: G90
3:	15: G94
6: G17	16: CFC
7: G40	21: SOFT
8: G54	22: CUT2DF
9:	29: DIAMOF
10: G60	30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

机床轴 MX1 余程=0, MY1 余程=-160, MZ1 余程=0

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NC/WKS/LIFT/LIFT_01_2

active

MRD ⚠ Wait: Axis enable missing YY

Machine	Position [mm]	Dist-to-go	T,F,S	Head
MX1	0.000	0.000	T CUTTER_LIFT	∅ 0.000
-MY1	0.000	-160.000	D1	L 50.000
MZ1	50.000	0.000	F 0.000	
MA1	90.000 °	0.000	1000.000 mm/min 120%	
MC1	0.000 °	0.000	S1 0	
			Master 0	0.0%

G54 X

NC/WKS/LIFT/LIFT_01_2

N120 M0

N130 G1 Z10 F1000

N140 M0

N150 M30

G functions

1: G1

2:

3:

6: G17

7: G40

8: G54

9:

10: G60

13: G710

14: G90

15: G94

16: CFC

21: SOFT

22: CUT2DF

29: DIAMOF

30: COMPOF

Act. values Machine

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

5.3.1.2 N130 执行后
几何轴 X=0, Y=150, Z=10

NC/WKS/LIFT/LIFT_01_2

interrupted

MRD ⚠ Stop: M0/M1 active

Work	Position [mm]	Dist-to-go	T,F,S	Head
X	0.000	0.000	T CUTTER_LIFT	∅ 0.000
Y	150.000	0.000	D1	L 50.000
Z	10.000	0.000	F 0.000	
A	90.000 °	0.000	1000.000 mm/min 120%	
C	0.000 °	0.000	S1 0	
			Master 0	0.0%

G54 X

NC/WKS/LIFT/LIFT_01_2

N130 G1 Z10 F1000

N140 M0

N150 M30

G functions

1: G1	13: G710
2:	14: G90
3:	15: G94
6: G17	16: CFC
7: G40	21: SOFT
8: G54	22: CUT2DF
9:	29: DIAMOF
10: G60	30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

机床轴 MX1=0, MY1=-160, MZ1=50

SIEMENS

SINUMERIK OPERATE

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M

AUTO

NC/WKS/LIFT/LIFT_01_2

interrupted

MRD ⚠ Stop: M0/M1 active

Machine	Position [mm]	Dist-to-go	T,F,S	Head
MX1	0.000	0.000	T CUTTER_LIFT	∅ 0.000 L 50.000
MY1	-160.000	0.000	D1	
MZ1	50.000	0.000	F 0.000	1000.000 mm/min 120%
MA1	90.000 °	0.000	S1 0	0.0%
MC1	0.000 °	0.000	Master 0	0.0%

G54 X

NC/WKS/LIFT/LIFT_01_2

N130 G1 Z10 F1000

N140 M0

N150 M30

G functions

1: G1

2:

3:

6: G17

7: G40

8: G54

9:

10: G60

13: G710

14: G90

15: G94

16: CFC

21: SOFT

22: CUT2DF

29: DIAMOF

30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

G functions

Auxiliary functions

Basic blocks

Time / counter

Program levels

Act. values Machine

5.4 测试 2：外部中断控制刀具法向退刀

- AUTO 方式执行 N120 处 M0 停止，中断触发几何轴 Z 从轮廓回退移动到 Z10
- 动作说明 外部中断控制刀具法向退刀和 AUTO 下执行程序 N130 结果一致

5.4.1 触发中断前

几何轴 X=0, Y=150, Z=-150

NC/WKS/LIFT/LIFT_01_2

interrupted

MRD ⚠ Stop: M0/M1 active

Work	Position [mm]	Dist-to-go	T,F,S	Head
X	0.000	0.000	T CUTTER_LIFT	∅ 0.000
Y	150.000	0.000	D1	L 50.000
Z	-150.000	0.000	F RAP TRAV	
A	90.000 °	0.000	mm/min 100%	
C	0.000 °	0.000		
G54			S1 0	0.0%
			Master 0	

NC/WKS/LIFT/LIFT_01_2

N110 CYCLE800(0, "Head", 100000, 39, 0, 0, 0, 0, 90, 0, 0, 0, -1, 100, 1)¶

N120 M0¶

N130 G1 Z10 F1000¶

N140 M0¶

N150 M30¶

¶

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

机床轴 MX1=0, MY1=0, MZ1=50, MA1=90, MC1=0

SIEMENS

SINUMERIK OPERATE

02/23/17 4:56 PM

M

AUTO

NC/WKS/LIFT/LIFT_01_2

interrupted

MRD Stop: M0/M1 active

Machine	Position [mm]	Dist-to-go	T,F,S	Head
MX1	0.000	0.000	T CUTTER_LIFT	∅ 0.000
MY1	0.000	0.000	D1	L 50.000
MZ1	50.000	0.000	F RAP TRAV	mm/min 100%
MA1	90.000 °	0.000	S1 0	
MC1	0.000 °	0.000	Master 0	0.0%

G54

NC/WKS/LIFT/LIFT_01_2

N110 CYCLE800(0, "Head", 100000, 39, 0, 0, 0, 0, 90, 0, 0, 0, 0, -1, 100, 1) ;

N120 M0 ;

N130 G1 Z10 F1000 ;

N140 M0 ;

N150 M30 ;

;

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

G functions

Auxiliary functions

Basic blocks

Time / counter

Program levels

Act. values Machine

5.4.2 MCP 按键 I7.7 触发中断，报警 16010，同时几何轴 Z 回退到 Z=10 处

- 说明 刀具旋转 C=0, A=90；中断编程 N70 POLF[Z]=10 控制几何轴 Z 移动到 Z=10，实际上是机床轴 MY1 移动

5.4.3 触发中断后

几何轴 X=0, Y=150, Z=10

16010

Block N120 machining stop after lift fast

M

AUTO

NC/WKS/LIFT/LIFT_01_2

interrupted

MRD Faulty NC block / user alarm

Work	Position [mm]	Dist-to-go	T,F,S	Head
X	0.000	0.000	T CUTTER_LIFT	∅ 0.000
Y	150.000	0.000	D1	L 50.000
Z	10.000	0.000	F RAP TRAV	mm/min 100%
A	90.000 °	0.000	S1 0	
C	0.000 °	0.000	Master 0	0.0%

G54

NC/WKS/LIFT/LIFT_01_2

N110 CYCLE800(0, "Head", 100000, 39, 0, 0, 0, 0,
N120 M0
N130 G1 Z10 F1000
N140 M0
N150 M30

G functions

1: G0 13: G710
2: 14: G90
3: 15: G94
6: G17 16: CFC
7: G40 21: SOFT
8: G54 22: CUT2DF
9: 29: DIAMOF
10: G60 30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

机床轴 MX1=0, MY1=-160, MZ1=50, MA1=90, MC1=0

第 16 页

16010

Block N120 machining stop after lift fast

M

AUTO

NC/WKS/LIFT/LIFT_01_2

interrupted

MRD Faulty NC block / user alarm

Machine	Position [mm]	Dist-to-go	T,F,S	Head
MX1	0.000	0.000	T CUTTER_LIFT	∅ 0.000
MY1	-160.000	0.000	D1	L 50.000
MZ1	50.000	0.000	F RAP TRAV	mm/min 100%
MA1	90.000 °	0.000	S1 0	
MC1	0.000 °	0.000	Master 0	0.0%

G54

NC/WKS/LIFT/LIFT_01_2

G functions

N110 CYCLE800(0, "Head", 100000, 39, 0, 0, 0, 0,	1: G0	13: G710
N120 M0	2:	14: G90
N130 G1 Z10 F1000	3:	15: G94
N140 M0	6: G17	16: CFC
N150 M30	7: G40	21: SOFT
	8: G54	22: CUT2DF
	9:	29: DIAMOF
	10: G60	30: COMPOF

Over-store

Prog. cntl.

Block search

Simult. record.

Prog. corr.

6 使用 TRAORI 和 TOFRAME 改变刀具方向后(C=0 A=90)后, 控制刀具法向退刀

```

N10 TRAFOOF
N20 CYCLE800(0, "0", 100000, 30, 0, 0, 0, 90, 0, 0, 0, 0, 0, -1, 100, 1)
N30 M0
N40 SUPA G0 X0 Y0 Z0 C0 A0
N50 M0
N60 LFPOS ;由POLFMASK 和POLF指定轴的回退的位置,
N70 POLF[Z]=10
N80 POLFMASK(Z)
N90 SETINT(1) PRIO=1 LIFTFAST
N100 M0
N110 T="CUTTER_LIFT"
N120 M6
N130 D1
N140 TRAORI
N150 ORIWKS
N160 TOFRAME
N170 M0
N180 G0 A90
N190 M0
N200 G1 Z10 F1000
N210 M0
N220 TRAFOOF
N230 M30
  
```


6.1 刀具摆动(C=0 A=90)后, 刀具法向回退功能测试

6.1.1 刀具参数

Tool list											
Loc.	Type	Tool name	ST	D	Length	∅		N			
		CUTTER_LIFT	1	1	50.000	10.000		0			

6.1.2 矢量偏移

```
; I3 - Base_Tool_X
N24650 $MC_TRAFO5_BASE_TOOL_2[0]=0
N24650 $MC_TRAFO5_BASE_TOOL_2[1]=0
N24650 $MC_TRAFO5_BASE_TOOL_2[2]=0 ;100

; I2 - Joint_offset_X
N24660 $MC_TRAFO5_JOINT_OFFSET_2[0]=0
N24660 $MC_TRAFO5_JOINT_OFFSET_2[1]=0
N24660 $MC_TRAFO5_JOINT_OFFSET_2[2]=0

; I1 - Part_Offset =-(Base_Tool_X+Joint_offset_X)
N24600 $MC_TRAFO5_PART_OFFSET_2[0]=0
N24600 $MC_TRAFO5_PART_OFFSET_2[1]=0
N24600 $MC_TRAFO5_PART_OFFSET_2[2]=0 ; -100
```

6.2 程序执行到 N190 处 M0 停止, 刀具摆动 C=0 A=90

几何轴 X=0, Y=0, Z=0

NC/WKS/LIFT/LIFT_02_TRAORI_2

interrupted

MRD ⚠ Stop: M0/M1 active

Work	Position [mm]	Dist-to-go	T,F,S
X	0.000	0.000	T CUTTER_LIFT
Y	0.000	0.000	D1
Z	0.000	0.000	F RAP TRAV
A	90.000 °	0.000	mm/min 100%
C	0.000 °	0.000	

G54

NC/WKS/LIFT/LIFT_02_TRAORI_2

N180 G0 A90

N190 M0

N200 G1 Z10 F1000

N210 M0

N220 TRAFOOF

N230 M30

I

G functions

TRAORI

1: G0	13: G710
2:	14: G90
3:	15: G94
6: G17	16: CFC
7: G40	21: SOFT
8: G54	22: CUT2D
9:	29: DIAMOF
10: G60	30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

机床轴 MX1=0, MY1=0, MZ1=50, MA1=90, MC1=0

SIEMENS

SINUMERIK OPERATE

02/23/17
5:34 PM

M

AUTO

NC/WKS/LIFT/LIFT_02_TRAORI_2

interrupted

MRD ⚠ Stop: M0/M1 active

Machine	Position [mm]	Dist-to-go	T,F,S
MX1	0.000	0.000	T CUTTER_LIFT Ø 0.000
MY1	0.000	0.000	D1 L 50.000
MZ1	50.000	0.000	F RAP TRAV
MA1	90.000 °	0.000	mm/min 100%
MC1	0.000 °	0.000	

G54

NC/WKS/LIFT/LIFT_02_TRAORI_2

G functions

TRAORI

N180 G0 A90

N190 M0

N200 G1 Z10 F1000

N210 M0

N220 TRAFOOF

N230 M30

1: G0

2:

3:

6: G17

7: G40

8: G54

9:

10: G60

13: G710

14: G90

15: G94

16: CFC

21: SOFT

22: CUT2D

29: DIAMOF

30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

有效的 G 功能，

SIEMENS

SINUMERIK OPERATE

02/23/17
5:34 PM

M

AUTO

NC/WKS/LIFT/LIFT_02_TRAORI_2

interrupted

MRD ⚠ Stop: M0/M1 active

G functions

TRAORI

1: G0	17: NORM	33: FTOCOF	49: CP	CTOL: 0.000
2:	18: G450	34: OSOF	50: ORIEULER	OTOL: 0.000
3:	19: BNAT	35: SPOF	51: ORIVECT	STOLF 3.000
4: FIFCTRL	20: ENAT	36: PDELAYON	52: PAROTOF	
5:	21: SOFT	37: FNORM	53: TOFRAME	
6: G17	22: CUT2D	38: SPIF1	54: ORIROTA	
7: G40	23: CDOF	39: CPRECOF	55: RTLION	
8: G54	24: FFWOF	40: CUTCONOF	56: TOWSTD	
9:	25: ORIWKS	41: LFOF	57: FENDNORM	
10: G60	26: RMI	42: TCOABS	58: RELIEUEOF	
11:	27: ORIC	43: G140	59: DYNNORM	
12: G601	28: WALIMON	44: G340	60: WALCS0	
13: G710	29: DIAMOF	45: SPATH	61: ORISOF	
14: G90	30: COMPOF	46: LFPOS	62:	
15: G94	31: G810	47: G290	63:	
16: CFC	32: G820	48: G462	64: GFRAME0	

G54

T=CUTTER_LIFT

RAP TRAU

S1=0

Back

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

6.3 测试 1：程序控制刀具法向退刀

- AUTO 方式执行 N200 控制几何轴 Z 移动到 Z10

N200 G1 Z10 F1000

6.3.1 执行 N200 G1 Z10 F1000

- 说明 刀具旋转 C=0, A=90; 编程 N200 G1 Z10 F1000 控制几何轴 Z, 实际上是机床轴 MY1 移动

6.3.1.1 N130 执行前

几何轴 X 余程=0, Y 余程=0, Z 余程=10

NC/WKS/LIFT/LIFT_02_TRAORI_2

active

MRD ⚠ Wait: Axis enable missing YY ZZ

Work	Position [mm]	Dist-to-go
X	0.000	0.000
Y	0.000	0.000
+Z	0.000	10.000
A	90.000 °	0.000
C	0.000 °	0.000

T CUTTER_LIFT ∅ 10.000
D1 L 50.000F 0.000
1000.000 mm/min 120%S1 0
Master 0 0.0%

G54

NC/WKS/LIFT/LIFT_02_TRAORI_2

G functions

TRAORI

N190 M0

N200 G1 Z10 F1000

N210 M0

N220 TRAFOOF

N230 M30

1: G1	13: G710
2:	14: G90
3:	15: G94
6: G17	16: CFC
7: G40	21: SOFT
8: G54	22: CUT2D
9:	29: DIAMOF
10: G60	30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

机床轴 MX1 余程=0, MY1 余程=10, MZ1 余程=0

SIEMENS

SINUMERIK OPERATE 02/24/17 11:11 AM

M

AUTO

NC/WKS/LIFT/LIFT_02_TRAORI_2

active

MRD ⚠ Wait: Axis enable missing YY ZZ

Machine	Position [mm]	Dist-to-go	T,F,S
MX1	0.000	0.000	T CUTTER_LIFT Ø 10.000 D1 L 50.000
+ MY1	0.000	10.000	F 0.000 1000.000 mm/min 120%
+ MZ1	50.000	0.000	S1 0
MA1	90.000 °	0.000	Master 0
MC1	0.000 °	0.000	

G54

NC/WKS/LIFT/LIFT_02_TRAORI_2

G functions TRAORI

N190 M0

N200 G1 Z10 F1000

N210 M0

N220 TRAFOOF

N230 M30

1: G1

2:

3:

6: G17

7: G40

8: G54

9:

10: G60

13: G710

14: G90

15: G94

16: CFC

21: SOFT

22: CUT2D

29: DIAMOF

30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

6.3.1.2 N200 执行后
几何轴 X=0, Y=0, Z=10

NC/WKS/LIFT/LIFT_02_TRAORI_2

interrupted

MRD ⚠ Stop: M0/M1 active

Work	Position [mm]	Dist-to-go	T,F,S
X	0.000	0.000	T CUTTER_LIFT ∅ 10.000
Y	0.000	0.000	D1 L 50.000
Z	10.000	0.000	F 0.000
A	90.000 °	0.000	1000.000 mm/min 120%
C	0.000 °	0.000	S1 0

G54

NC/WKS/LIFT/LIFT_02_TRAORI_2

N200 G1 Z10 F1000

N210 M0

N220 TRAFOOF

N230 M30

G functions

TRAORI

1: G1	13: G710
2:	14: G90
3:	15: G94
6: G17	16: CFC
7: G40	21: SOFT
8: G54	22: CUT2D
9:	29: DIAMOF
10: G60	30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

机床轴 MX1=0, MY1=10, MZ1=50

SIEMENS

SINUMERIK OPERATE

02/24/17
11:12 AM

M

AUTO

NC/WKS/LIFT/LIFT_02_TRAORI_2

interrupted

MRD ⚠ Stop: M0/M1 active

Machine	Position [mm]	Dist-to-go	T,F,S
MX1	0.000	0.000	T CUTTER_LIFT ∅ 10.000
MY1	10.000	0.000	D1 L 50.000
MZ1	50.000	0.000	F 0.000
MA1	90.000 °	0.000	1000.000 mm/min 120%
MC1	0.000 °	0.000	S1 0
			Master 0

G54

0

50

100

NC/WKS/LIFT/LIFT_02_TRAORI_2

G functions

TRAORI

N200 G1 Z10 F1000	1: G1	13: G710
N210 M0	2:	14: G90
N220 TRAFOOF	3:	15: G94
N230 M30	6: G17	16: CFC
	7: G40	21: SOFT
	8: G54	22: CUT2D
	9:	29: DIAMOF
	10: G60	30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

6.4 测试 2：外部中断控制刀具法向退刀

- AUTO 方式执行 N190 处 M0 停止，中断触发几何轴 Z 从轮廓回退移动到 Z10
- 动作说明 外部中断控制刀具法向退刀和 AUTO 下执行程序 N200 结果一致

6.4.1 触发中断前

几何轴 X=0, Y=0, Z=-0

NC/WKS/LIFT/LIFT_02_TRAORI_2

interrupted

MRD ⚠ Stop: M0/M1 active

Work	Position [mm]	Dist-to-go	T,F,S
X	0.000	0.000	T CUTTER_LIFT Ø 10.000
Y	0.000	0.000	D1 L 50.000
Z	0.000	0.000	F RAP TRAV
A	90.000 °	0.000	mm/min 100%
C	0.000 °	0.000	S1 0 ☒
			Master 0 0.0%

G54

NC/WKS/LIFT/LIFT_02_TRAORI_2

G functions

TRAORI

N180 G0 A90

N190 M0

N200 G1 Z10 F1000

N210 M0

N220 TRAFOOF

N230 M30

1: G0	13: G710
2:	14: G90
3:	15: G94
6: G17	16: CFC
7: G40	21: SOFT
8: G54	22: CUT2D
9:	29: DIAMOF
10: G60	30: COMPOF



Overstore



Prog. cntrl.



Block search



Simult. record.



Prog. corr.

机床轴 MX1=0, MY1=0, MZ1=50, MA1=90, MC1=0

SIEMENS

SINUMERIK OPERATE

02/24/17
11:14 AM

M

AUTO

NC/WKS/LIFT/LIFT_02_TRAORI_2

interrupted

MRD ⚠ Stop: M0/M1 active

Machine	Position [mm]	Dist-to-go	T,F,S
MX1	0.000	0.000	T CUTTER_LIFT Ø 10.000
MY1	0.000	0.000	D1 L 50.000
MZ1	50.000	0.000	F RAP TRAV
MA1	90.000 °	0.000	mm/min 100%
MC1	0.000 °	0.000	S1 0
			Master 0 0.0%

G54

NC/WKS/LIFT/LIFT_02_TRAORI_2

N180 G0 A90

N190 M0

N200 G1 Z10 F1000

N210 M0

N220 TRAFOOF

N230 M30

G functions

TRAORI

1: G0

2:

3:

6: G17

7: G40

8: G54

9:

10: G60

13: G710

14: G90

15: G94

16: CFC

21: SOFT

22: CUT2D

29: DIAMOF

30: COMPOF

Over-store

Prog. cntrl.

Block search

Simult. record.

Prog. corr.

G functions

Auxiliary functions

Basic blocks

Time / counter

Program levels

Act. values Machine

6.4.2 MCP 按键 I7.7 触发中断，报警 16010，同时几何轴 Z 回退到 Z=10 处

- 说明 刀具旋转 C=0, A=90; 中断编程 N70 POLF[Z]=10 控制几何轴 Z 移动到 Z=10, 实际上是机床轴 MY1 移动

6.4.3 触发中断后

几何轴 X=0, Y=0, Z=10

机床轴 $MX1=0$, $MY1=10$, $MZ1=50$, $MA1=90$, $MC1=0$

MTSAPC