

## Practical No. 5

AIM: - Develop a part programme for the following milling operations and make the job on CNC milling (for finish pass only)- At least two (Material: Aluminium/Acrylic/Plastic rod)

- Plain milling
- Slot milling
- Contouring
- Pocket mill.

### Plain milling

Theory: The part program is a sequence of instruction, which describe the work, which has to be done on a part in the form required by a computer under the control of NC computer program. Plain milling operation is performed is face milling cutter of diameter 40 mm.

- i) Part Program for Plain milling of workpiece of size 100 (L) x 100 (W) x 50 (H)  
(All dimensions are in mm)  
Fig. 5.1(a), 5.1(b) and 5.1(c) represent the front view side view and top view of workpiece, respectively. Figure 5.2 is final workpiece after milling operation.

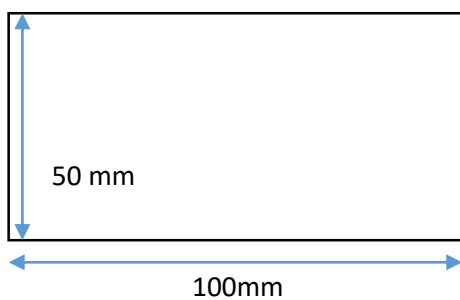


Fig 5.1(a) Front View

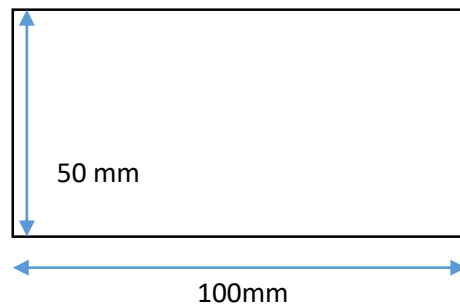


Fig 5.1(b) Side View

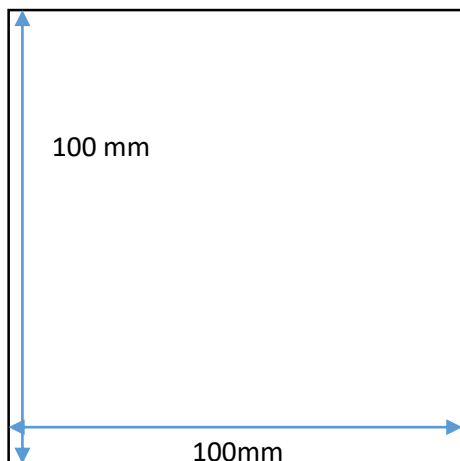


Fig 5.1(c) Top View

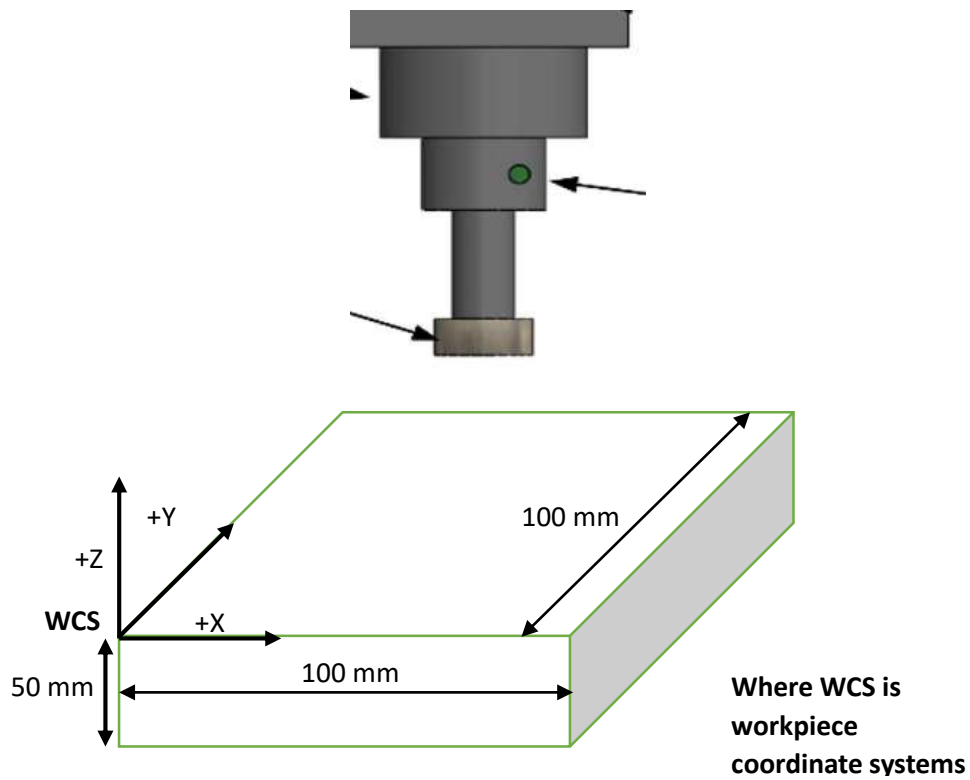


Fig 5.2 Coordinate system for CNC milling

Table 1 represent the program for plain milling and facing operation of Fig 5.2. Fig 5.3 represent tool path during cutting operation

Table 1 Program for Plain or Face milling Operation

Program	Comment
G90G54G17G71G40;	(Parameter settings)
G74X0.0Y0.0Z0.0;	(Return tool at home position)
M03S200;	(Spindle Rotate clock wise at 200 rpm)
M07;	(Coolant On)
G00X-20.0Y0.0;	(Rapid travel of tool near workpiece at safe position in X and Y direction)
Z1.0;	(Rapid travel of tool near workpiece at safe position in Z direction)
Z-1.0;	(depth of cut in z for face or plain milling operation)
G01X100.0F0.1;	(Cutting in X with feed rate in mm/min)
Y25.0;	(Cutting in Y with feed rate in mm/min)
X0.0;	(Cutting in X with feed rate in mm/min)
Y50.0;	(Cutting in Y with feed rate in mm/min)
X100.0;	(Cutting in X with feed rate in mm/min)
Y75.0;	(Cutting in Y with feed rate in mm/min)
X0.0;	(Cutting in X with feed rate in mm/min)
Y100.0;	(Cutting in Y with feed rate in mm/min)
X100.0;	(Cutting in X with feed rate in mm/min)
Z5.0;	(Retrieval of tool in Z direction)
G74Z0Y0Z0;	(Return tool at home position)
M09;	(Coolant off)
M05;	(Spindle stop)
M30;	(End of Program)

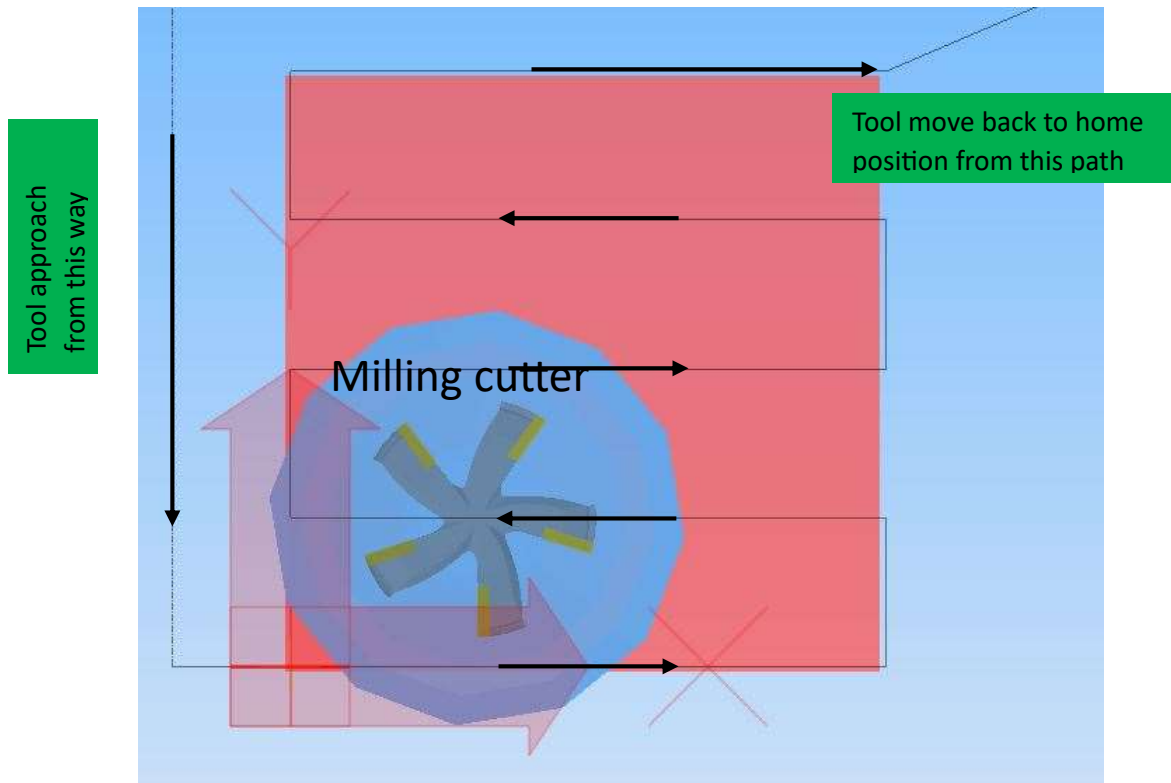


Fig 5.3 Tool path during milling operation

### Slot milling operation

Theory: Slot milling operation is performed using a 10 mm diameter cutter on milling machine.

- i) Part Program for slot milling of workpiece of 10mm slot size at center parallel to X direction.  
(All dimensions are in mm)

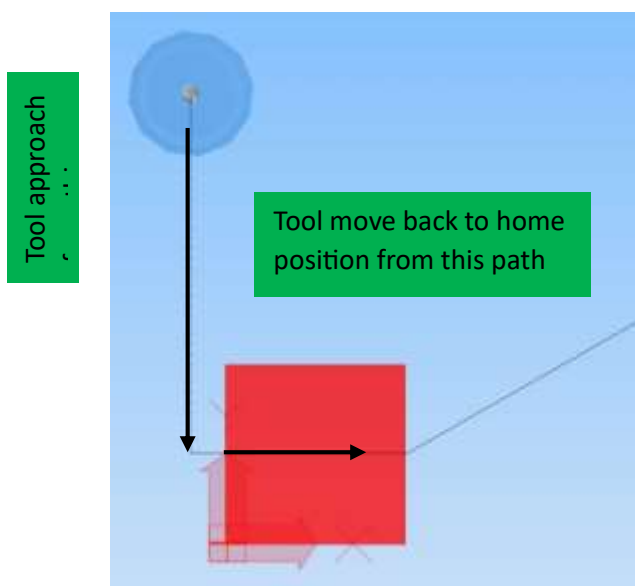


Fig 5.4 Tool position before slot milling

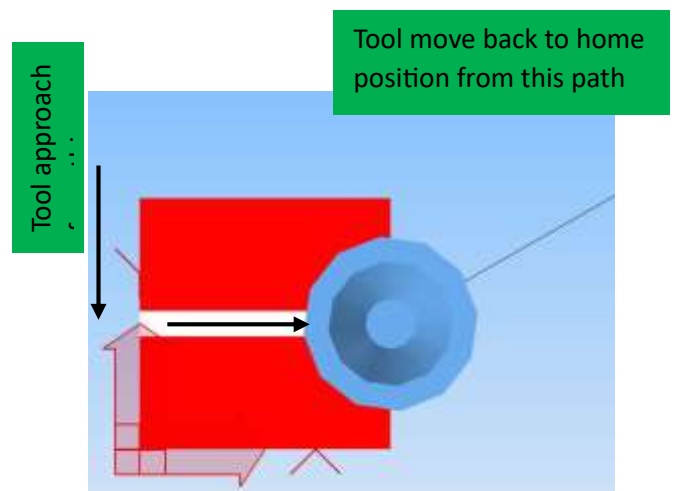


Fig 5.5 Tool position after slot milling

Table 2 represent the program for slot milling. Fig 5.4 and Fig 5.5 represent tool path during slot milling operation

*Table 2 Slot milling operation*

Program	Comment
G90G54G17G40;	(Parameter settings)
G74X0Y0Z0;	(Return tool at home position)
M03S200;	(Spindle Rotate clock wise at 200 rpm)
M07;	(Coolant On)
G00X-20.0;	(Rapid travel of tool near workpiece at safe position in X)
Y50.0;	(Rapid travel of tool near workpiece at safe position in Y)
Z1.0;	((Rapid travel of tool near workpiece at safe position in Z direction)
Z-10.0;	(depth of cut in z for slot milling operation)
G01X100.0F0.1;	(Cutting in X with feed rate in mm/min)
Z5.0;	(Retrieval of tool)
G74Z0Y0Z0;	(Return tool at home position)
M09;	(Coolant off)
M05;	(Spindle stop)
M30;	(End of Program)

### Contour milling operation

Theory: Contour milling operation is performed using a 10 mm diameter cutter on milling machine.

- i) Part Program for contour milling of workpiece as shown in fig 5.6  
(All dimensions are in mm)

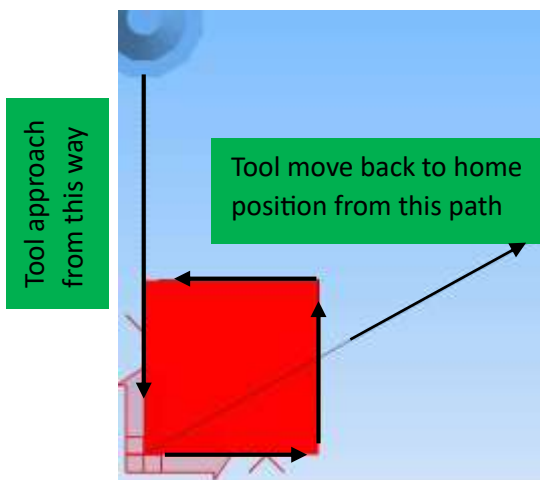


Fig 5.6 Tool position before contour milling

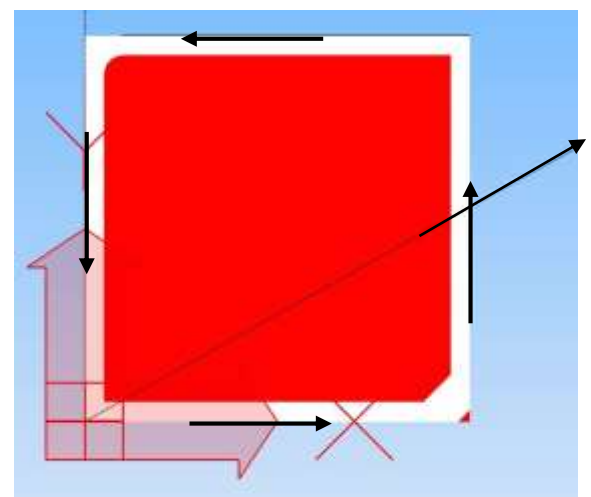


Fig 5.7 Tool path for contour milling

Table 3 represent the program for contour milling. Fig 5.6 and Fig 5.7 represent tool path during contour milling operation

*Table 3 contour milling operation*

Program	Comment
G90G54G17G40;	(Parameter settings)
G74X0Y0Z0;	(Return tool at home position)
M03S200;	(Spindle Rotate clock wise at 200 rpm)
M07;	(Coolant On)
G00X0.0;	(Rapid travel of tool near workpiece at safe position in X)
Y0.0;	(Rapid travel of tool near workpiece at safe position in Y)
Z1.0;	(Rapid travel of tool near workpiece at safe position in Z direction)
Z-1.0;	(depth of cut in z for slot milling operation)
G01X90.0F0.1;	(Cutting in X with feed rate in mm/min)
X100.0Y10.0;	(Cutting in X and Y with feed rate in mm/min)
Y100.0;	(Cutting in X and Y with feed rate in mm/min)
X10.0;	(Cutting in X with feed rate in mm/min)
G03X0.0Y90.0CR=10.0;	(Cutting in circular interpolation counter clockwise)
G01Y0.0;	(Cutting in Y with feed rate in mm/min)
Z5.0;	(Retrieval of tool)
G74Z0Y0Z0;	(Return tool at home position)
M09;	(Coolant off)
M05;	(Spindle stop)
M30;	(End of Program)

### Pocket milling operation

Theory: Contour milling operation is performed using a 10 mm diameter cutter on milling machine.

- Part Program for pocket milling of workpiece shown in fig 5.8 and 5.9 represent the finished workpiece. (All dimensions are in mm)

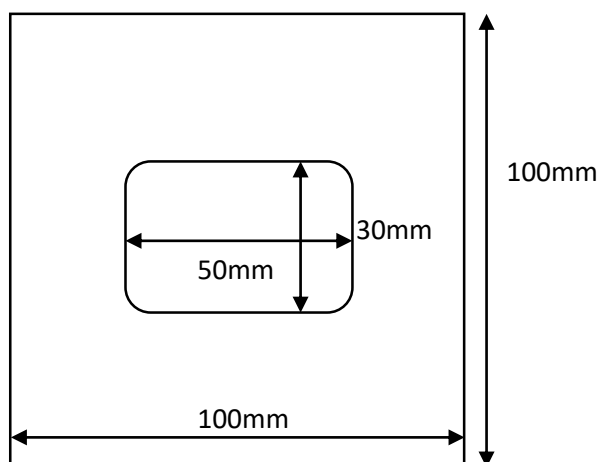


Fig 5.8 Pocket milling operation

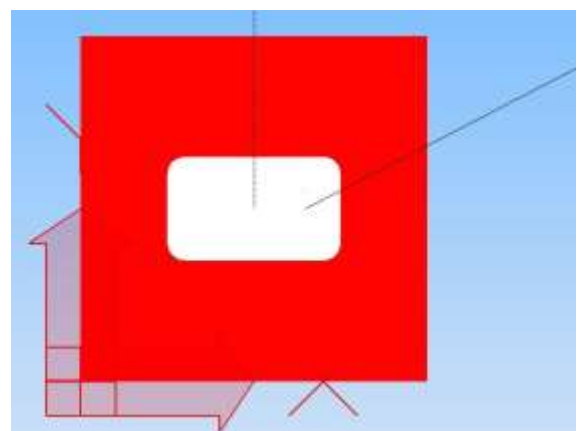


Fig 5.9 Pocket milling operation

Table 4 represent the program for pocket milling.

*Table 4 Pocket milling operation*

Program	Comment
G90G54G17G40;	(Parameter settings)
G74X0Y0Z0;	(Return tool at home position)
M03S200;	(Spindle Rotate clock wise at 200 rpm)
M07;	(Coolant On)
G00X50.0;	(Rapid travel of tool near workpiece at center position in X)
Y50.0;	(Rapid travel of tool near workpiece at center position in Y)
Z1.0;	(Rapid travel of tool near workpiece at safe position in Z direction)
Z-1.0;	(depth of cut in z for pocket milling operation)
G01X30.0F0.1;	(Cutting in X with feed rate in mm/min)
Y40.0;	(Cutting in Y with feed rate in mm/min)
X70.0;	(Cutting in X with feed rate in mm/min)
Y60.0;	(Cutting in Y with feed rate in mm/min)
X30.0;	(Cutting in X with feed rate in mm/min)
Y50.0;	(Cutting in Y with feed rate in mm/min)
X70.0;	(Cutting in X with feed rate in mm/min)
X69.0;	(Retrieval of tool in X)
Z5.0;	(Retrieval of tool in Z)
G74Z0Y0Z0;	(Return tool at home position)
M09;	(Coolant off)
M05;	(Spindle stop)
M30;	(End of Program)