1   GENERAL

1.1　TOOL MOVEMENT ALONG WORKPIECE PARTS　FIGURE-INTERPOLATION

The tool moves along straight lines and arcs constituting the workpiece parts figure.

Explanations

The function of moving the tool along straight lines and arcs is called the interpolation.
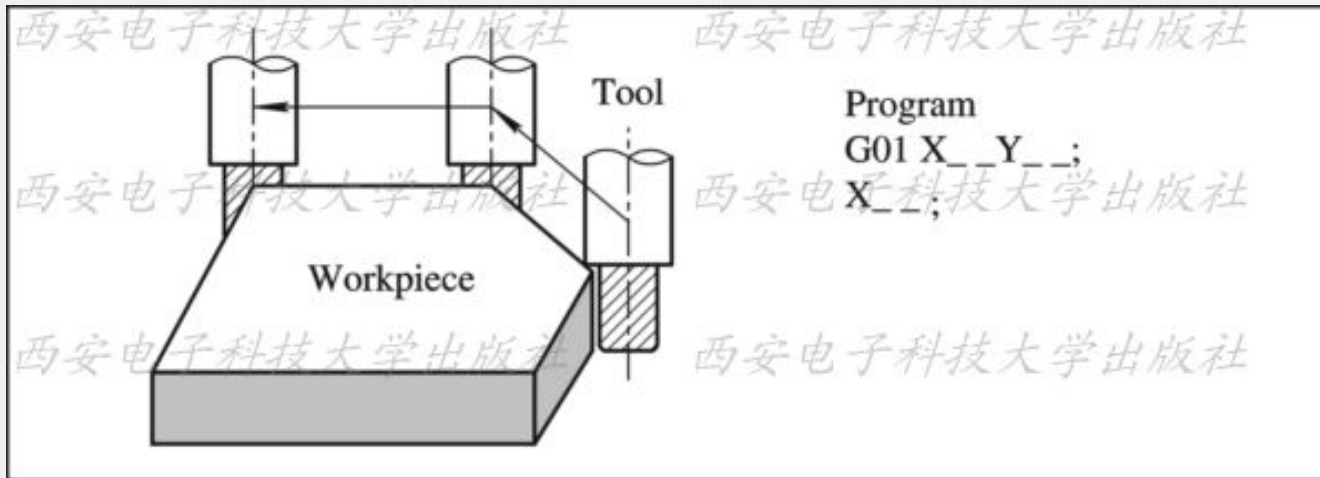
· **Tool movement along a straight line**

Fig.1.1(a) Tool movement along a straight line

· **Tool movement along an arc**

Fig.1.1(b) Tool movement along an arc

Symbols of the programmed commands G01, G02, … are called the preparatory function and specify the type of interpolation conducted in the control unit.
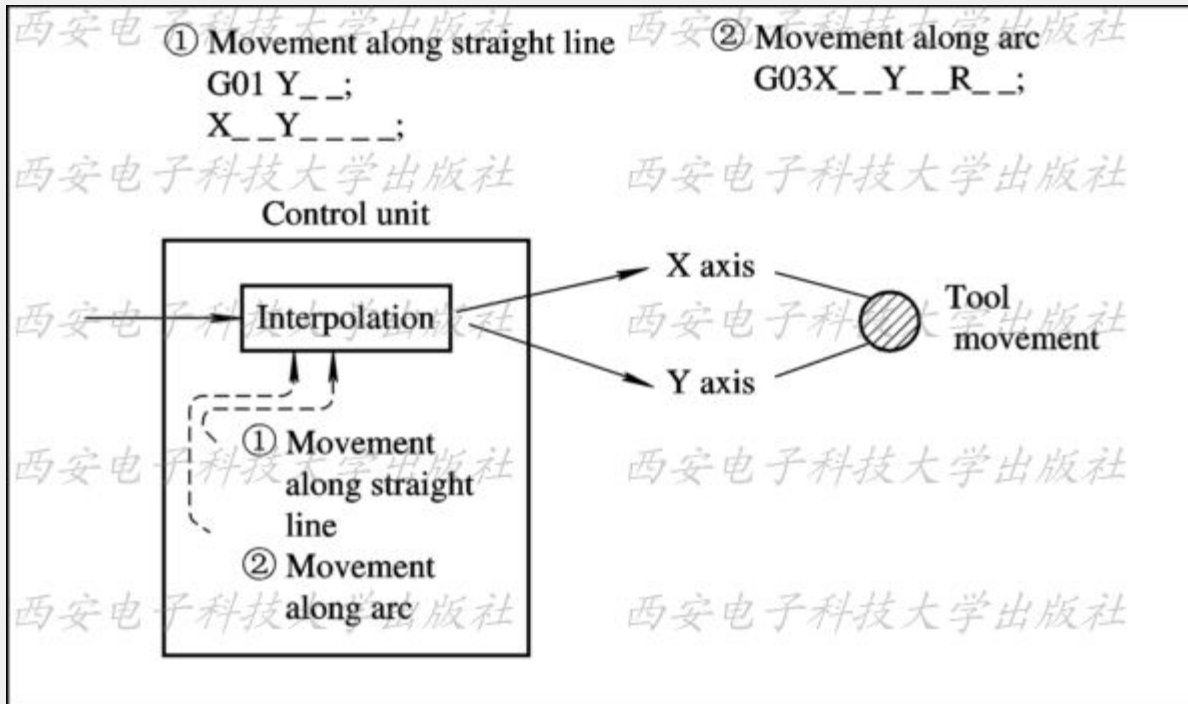
Fig.1.1(c) Interpolation function

NOTE

Some machines move tables instead of tools but this book assumes that tools are moved against workpieces.

1.2   FEED FUNCTION

Movement of the tool at a specified speed for cutting a workpiece is called the feed.
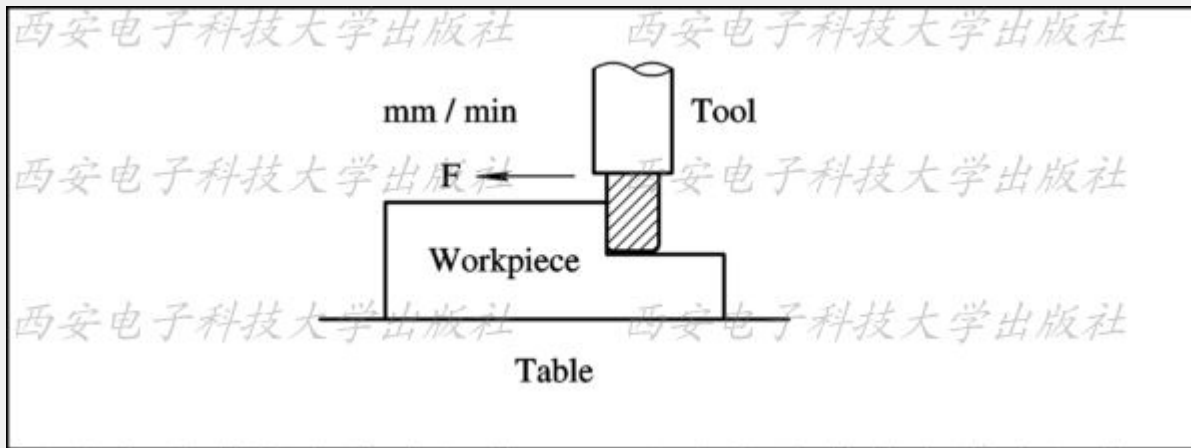
mm / min   Tool

F

Workpiece

Table

Fig.1.2   Feed function

Feedrates can be specified by using actual numerics. For example, to feed the tool at a rate of 150 mm/min, specify the following in the program:

F150.0

The function of deciding the feedrate is called the feed function.

1.3 PART DRAWING AND TOOL MOVEMENT

1.3.1 Reference Position (Machine-Specific Position)

A CNC machine tool is provided with a fixed position. Normally, tool change and programming of absolute zero point as described later are performed at this position. This position is called the reference position.
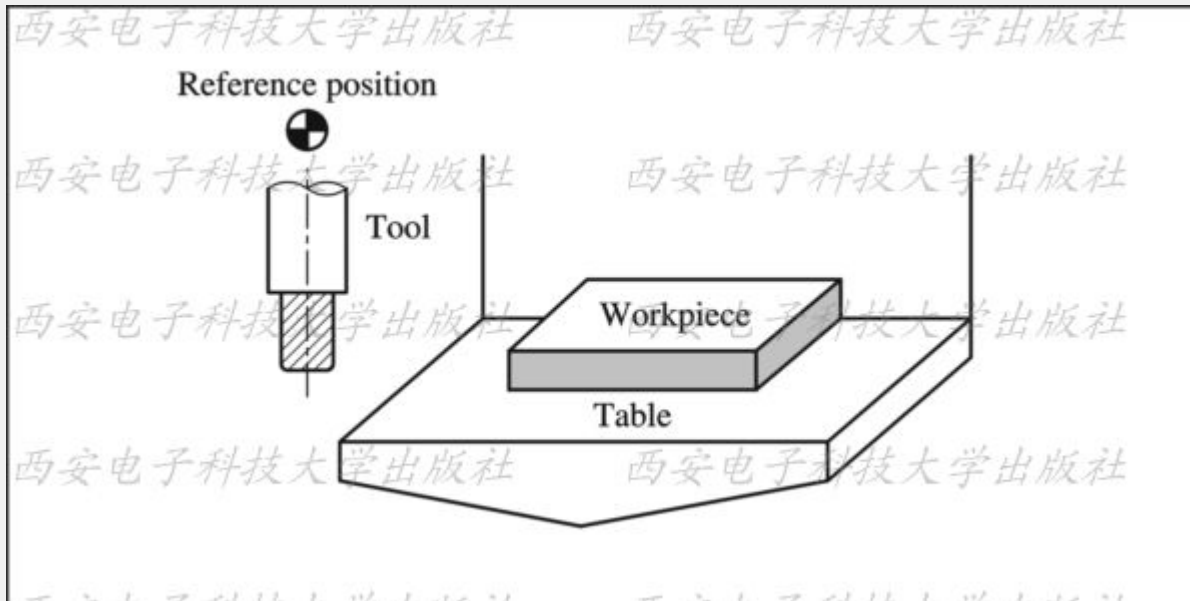
Fig.1.3 (a) Reference position

Explanations

The tool can be moved to the reference position in two ways:

(i) Manual reference position return.

Reference position return is performed by manual button operation.

(ii) Automatic reference position return.

In general, manual reference position return is performed first after the poweris turned on. In order to move the tool to the reference position for tool change thereafter, the function of automatic reference position return is used.

1.3.2　Coordinate System on Part Drawing and Coordinate　System Specified by CNC- Coordinate System
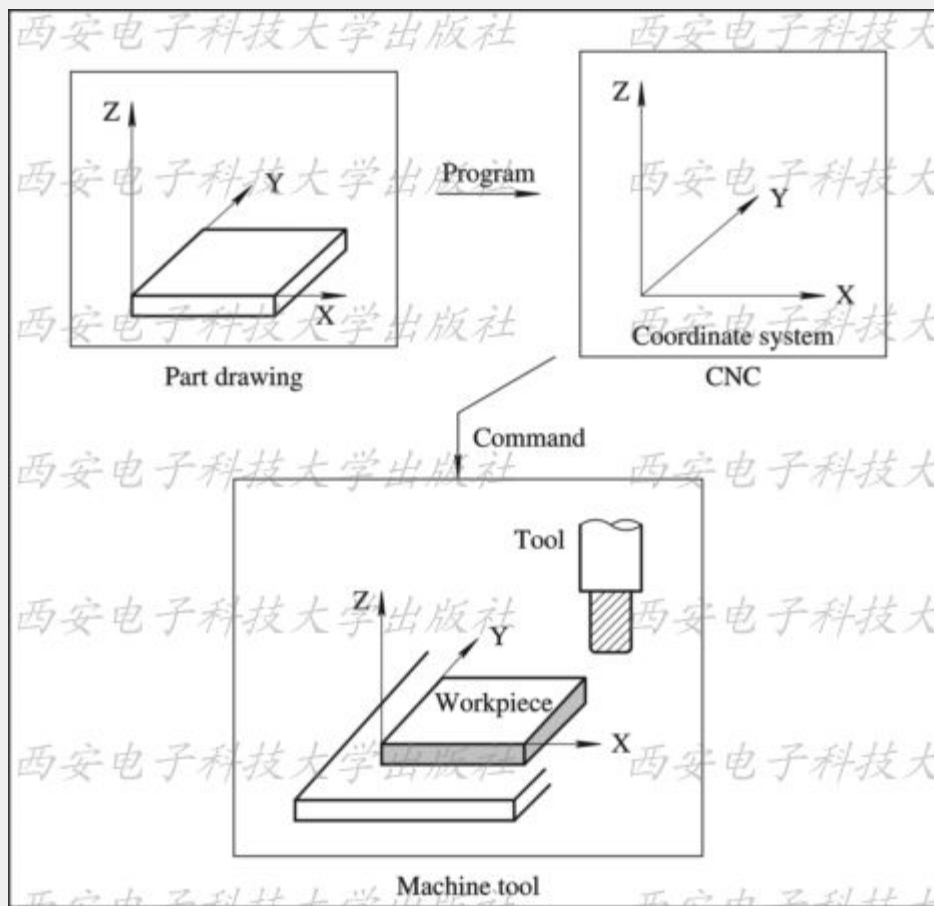
Fig.1.3(b) Coordinate system

Explanations

· **Coordinate system**

The following two coordinate systems are specified at different locations:

(i) Coordinate system on part drawing.

The coordinate system is written on the part drawing. As the program data, the coordinate values on this coordinate system are used.

(ii) Coordinate system specified by the CNC.

The coordinate system is prepared on the actual machine tool table.

This can be achieved by programming the distance from the current position of the tool to the zero point of the coordinate system to be set.
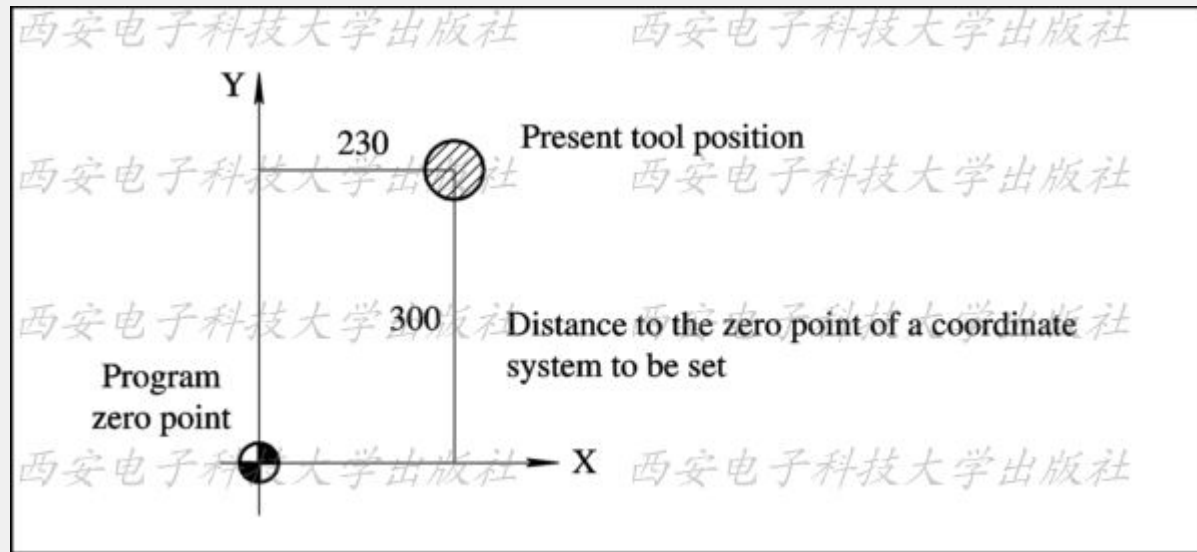
Fig.1.3(c) Coordinate system specified by the CNC

The positional relation between these two coordinate systems is determined when a workpiece is set on the table.
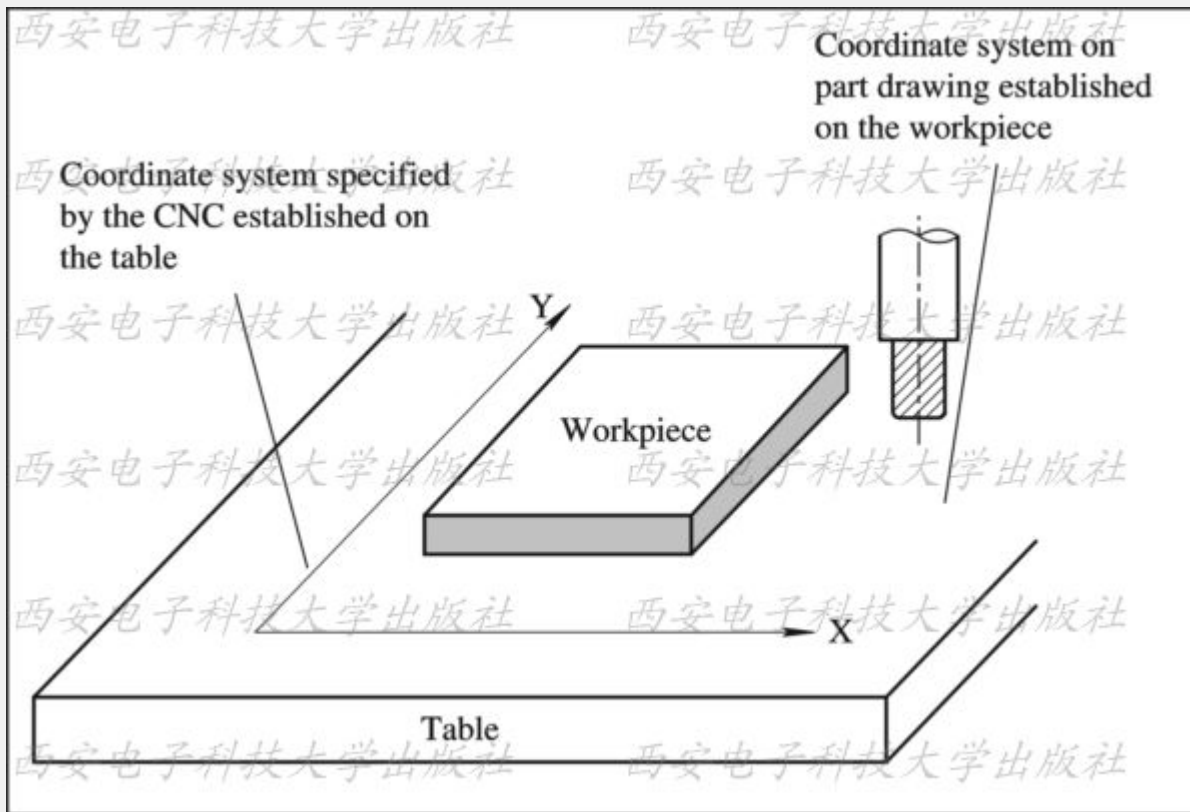
Fig.1.3(d) Coordinate system specified by CNC and coordinate system on part drawing

The tool moves on the coordinate system specified by the CNC in accordance with the command program generated with respect to the coordinate system on the part drawing, and cuts a workpiece into a shape on the drawing.

Therefore, in order to correctly cut the workpiece as specified on the drawing, the two coordinate systems must be set at the same position.

· **Methods of setting the two coordinate systems in the same position**

To set the two coordinate systems at the same position, simple methods shall be used according to workpiece shape, the number of machinings.

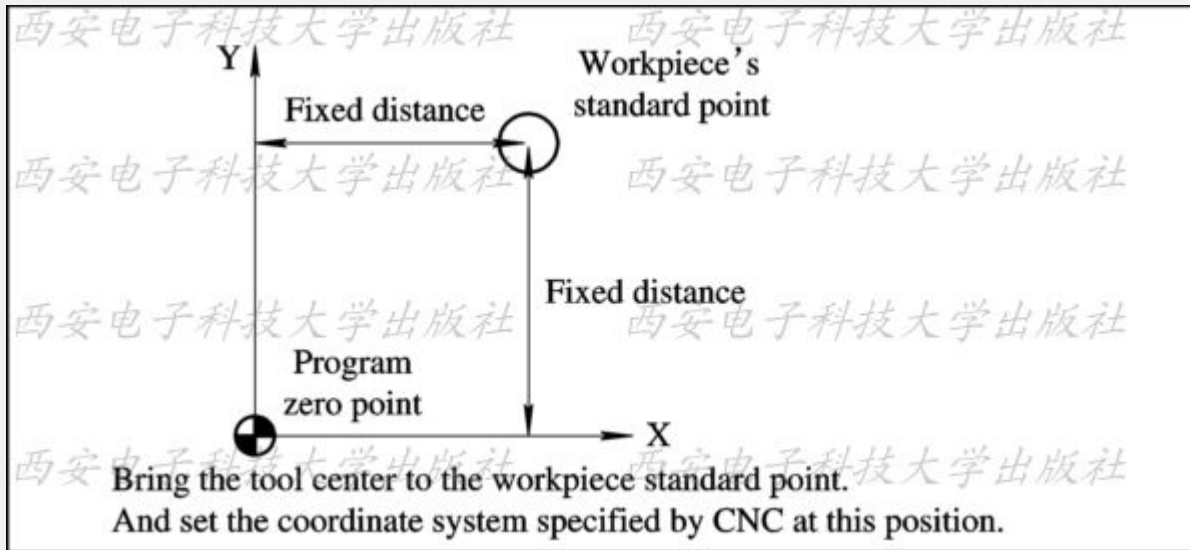(i) Using a standard plane and point of the workpiece.

Fig.1.3(e) Set the coordinate systems by using a standard plane

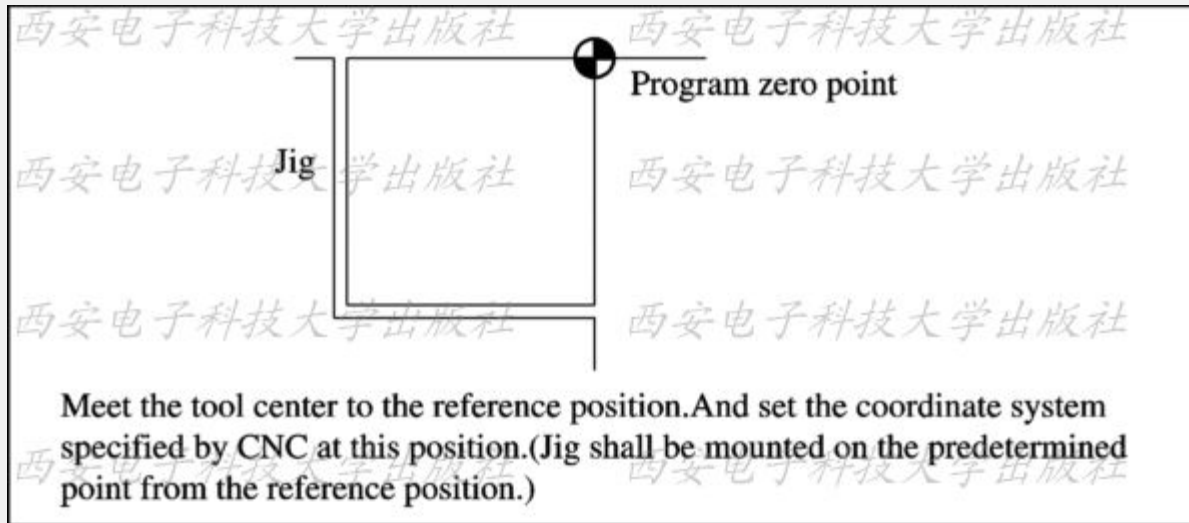(ii) Mounting a workpiece directly against the jig.

Program zero point

Jig

Meet the tool center to the reference position. And set the coordinate system specified by CNC at this position. (Jig shall be mounted on the predetermined point from the reference position.)

Fig.1.3(f) Mounting a workpiece directly against the jig

(iii) Mounting a workpiece on a pallet, then mounting the workpiece and pallet on the jig.
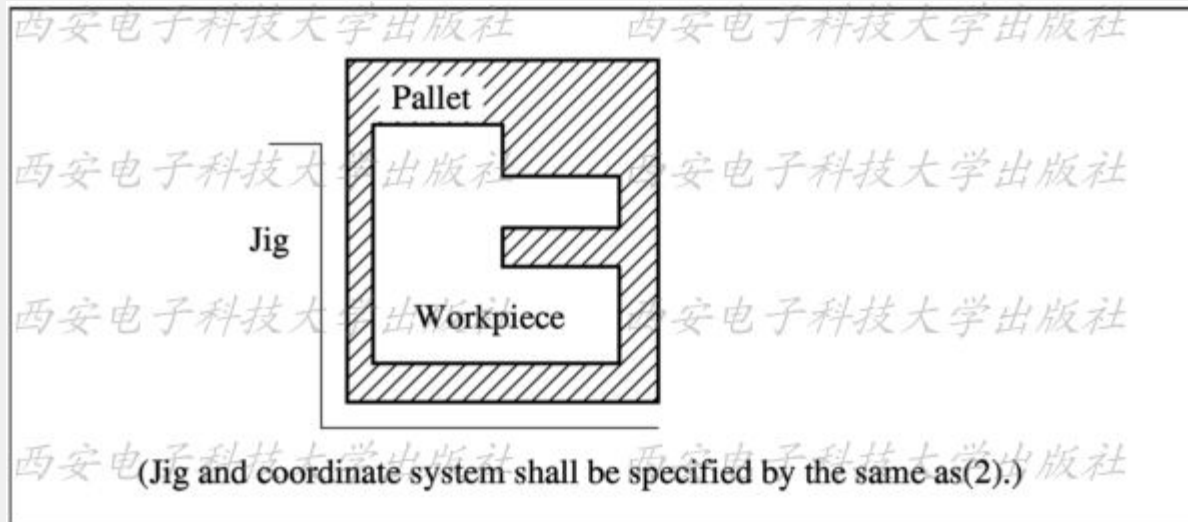

(Jig and coordinate system shall be specified by the same as(2).)

Fig.1.3(g) Mounting a workpiece

1.3.3 How to Indicate Command Dimensions for Moving the   Tool - Absolute, Incremental Commands

Explanations

Command for moving the tool can be indicated by absolute command or incremental command.

· Absolute command

The tool moves to a point at "the distance from zero point of the coordinate system" that is to the position of the oordinate values.
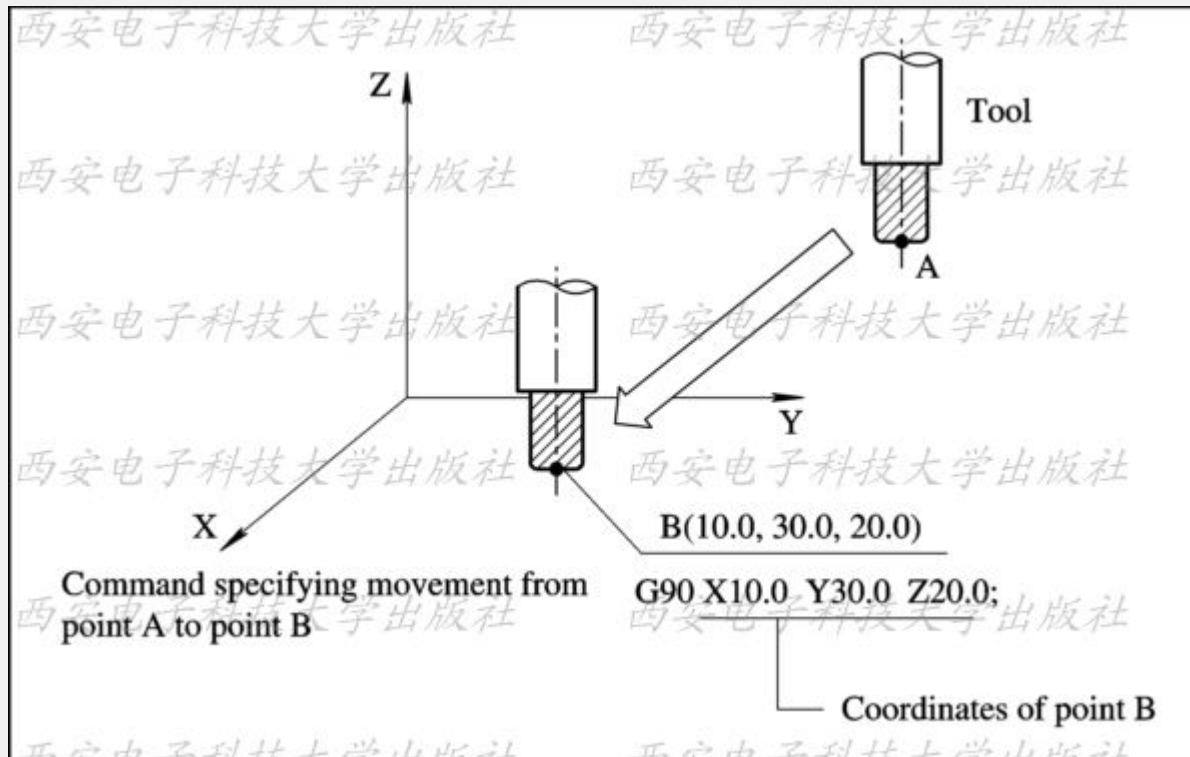
Fig. 1.3(h) Absolute command

· **Incremental command**

　Specify the distance from the previous tool position to the next tool position.

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